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BIOMECHANICAL STUDY ATHLETES' MOVEMENT TECHNIQUES IN THE HURDLES (ON EXAMPLE OF PHASE OF FLIGHT)

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Annotation. *Purpose:* To design a theoretical biomechanical model of athletes' movement techniques in the hurdles and then check there movements on real athletes. *Material:* In the practical part of the study participated 10 smortsmen. *Results:* Showing the possibility of constructing a theoretical model of hurdling technique. The basis of constructing a model using the known approaches in theoretical mechanics. Shows the calculated and actual performance movement of the athlete. *Conclusions:* The developed model provides a good theoretical understanding of the interactions of individual elements of movement and the ability to simulate different situations and to determine the optimal values of the kinematic and dynamic characteristics of the movement of the athlete. The model allows the individual elements of motion correction directly in the process of training. When analyzing art movement should consider specific features of physical development and anthropometric characteristics of the athlete's body.

Keywords: model, biomechanics, hurdling, flight, phase.

Introduction

Simulation of different movements in sport functioning is an important element of analysis of its structure and its components, such as speed, acceleration, kinematic and dynamic characteristics. Alongside with it, with building of model itself it is necessary to know kind of sport and its characteristic features. Also it is important to correctly understand interconnections between separate elements of movement. All these in complex permit to create certain mechanical copy of actual movement. One of obstacles for creation of reliable model can be absence of possibility of its workability practical testing. However, even theoretical model creates good preconditions to constructing of real movement or to correction of its separate elements. That is why, bio-mechanical simulation is one of components of training and perfection of movements of both" beginners and experienced sportsmen.

In this context solution of practical tasks of sportsmen's preparation can be found on example of hurdling, whose important component is flight phase. It is known that sport result in hurdling is determined, mainly, by rational bio-mechanical characteristics, which a sportsman is able to realize at stages of smooth run and in flight phases. In flight phase such characteristics are determined by speed of pushing off, angle of take off, distance from barrier to center of sportsman's body mass (CBM), sportsman's CBM position in phases of pushing off and overcoming barrier, considering resistance of air.

Problems of creation of bio-mechanical models have been sufficiently elucidated in different works, oriented on solution of both general and approximated to certain kinds of sports tasks. It is necessary to specify fundamental works of such scientists like N.A. Bernstein [4], A.N. Laputin [15], D.D. Donskoy [11], S.V. Dmitriyev [10], who actually determined general direction of bio-mechanical models' creation and, thus, made basis and permitted building of certain sportsmen's movements.

Among other works, we can mark out the, works, oriented on certain kinds of sports: outdoor games (N.A. Nosko) [19]; S.V. Stroganov [26]), arm wrestling (L.V. Podrigalo, M.N. Galashko, N.I. Galashko [22]), run and walking (S.S. Yermakov, V.M. Adashevskiy [12]; V.M. Adashevskiy, S.S. Yermakov, Ye. Ziyelinskiy [2]; G.P. Shepelenko, Kr. Prusik, K. Prusik, S.S. Yermakov [33]), thae-quan do (V.M. Adashevskiy, S.S. Yermakov [1]), weight lifting (S.V. Sulim, K.N. Sergiyenko, A.V. Bakum [27]), track and fields (R.F. Akhmetov [3]; Leite Werlayne [39]), gymnastics (V.A. Potop, R. Grad, V.N. Boloban [23]; V.A. Potop, R. Grad, V.N. Boloban, A.P. Otsupok [24]). Besides, a number of researches of hurdling is reflected in publications of domestic and foreign authors: problems of technical training of junior hurdlers [16], women [17], general problems of sportsmen's trainings [20, 25, 35]. Bio-mechanical [3, 6, 12, 34, 36-38, 40-42] and other problems of sportsmen's training in track and fields and hurdling were reflected in some works [7-9, 14, 18, 28-32]. Among researches of hurdling bio-mechanical parameters the work by V.V. Mekhrikadze, V.V. Cherenev of 2008 [5] is of special interest. The authors note that technical level of hurdling step is conditioned by continued fulfillment of all five phases by the most flat trajectory of GCBM movement, the highest point of which is in front of barrier.

Alongside with it problems of hurdling technique still require more profound study, considering new conditions of sportsmen's training, moder equipment and technical devices.

Purpose, tasks of the work, material and methods

The purpose of the work is to build theoretical, bio-mechanical model of sportsman's movements with its further testing by real sportsmen's movements.

The tasks of the research:

- to compose calculation schema for determination of influence on efficiency of push off speed, sportsman's center of body mass take off angle, air resistance, position of sportsman's center of body mass in phase of pushing off and barrier's overcoming.
- to compose physical-mathematical model and solve the task of body flight dynamic.

In the research students-sportsmen of National technical university "Kharkov polytechnical institute" participated. Calculations were fulfilled with the help of program complex "KIDIM", which was worked out at theoretical mechanics department of NTU "KhPI".

Results of the research

Theoretical model of sportsman's movements permitted to mark out characteristics of body flight trajectory depending on the following: initial speed of sportsman's center of body mass take off; CBM take off angle; air resistance; distance from barrier to sportsmen's center of body mass.

At first stage of the research we composed calculation schema for determination of rational parameters in hurdling depending on initial take off speed, take off angle, height of take off and sportsman's center of body mass (see fig.1).

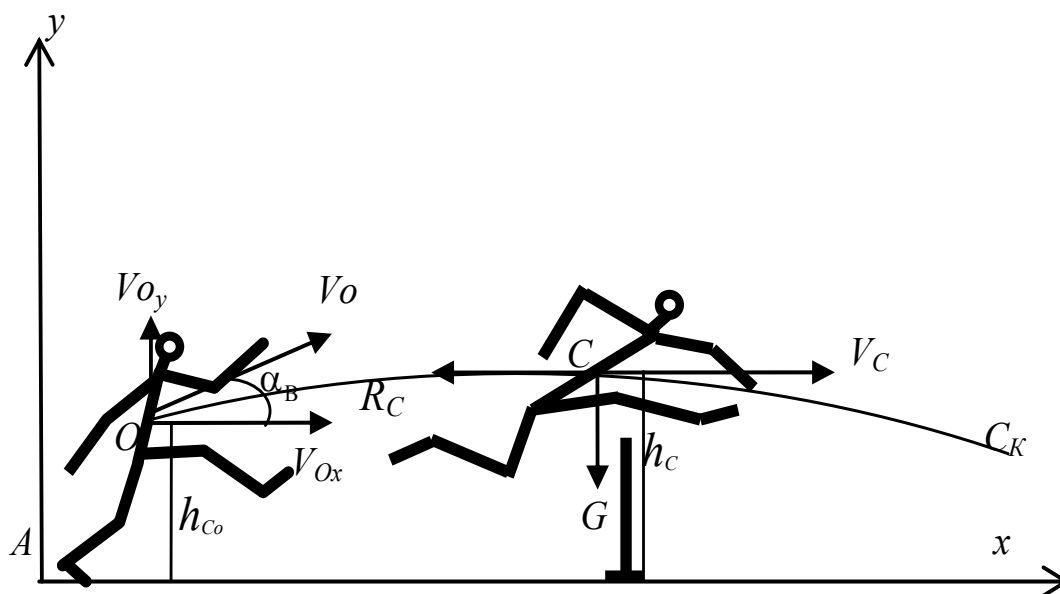


Fig.1. Calculation schema for determination of initial take off speed, take off angle, CMB take off height in front of barrier

$V_0 = V_{C0}$ - initial speed of center of mass body, V_{0x} - projection of take off of body mass center on axis Ox, V_{0y} - projection of take off speed of body mass center on axis Oy, V - current speed of body mass center.

Now let us regard influence of initial speed of take off, take off angle, height of take off and flight of body mass center, considering variable values of air resistance depending on sportsman's mid-section.

In projections on axes of Descartes absolute coordinates system:

$$v_{0x} = v_0 \cos \alpha_0; \quad v_{0y} = v_0 \sin \alpha_0$$

Absolute initial speed of body mass center's take off:

$$v_0 = \sqrt{v_{0x}^2 + v_{0y}^2}$$

$h_{C0} = h_0$ - height of body mass center's take off at initial moment of take off,

$\alpha_0 = \alpha_{C0}$ - take off angle of body mass center,

G - force of gravity of body,

R_c - force of air resistance.

For solution of this task force of air-dynamic resistance R_c for bodies, moving in air medium with density ρ , is

$$R_c = 0.5 \cdot c_r \rho S V^2; \quad R_c = k V^2.$$

With calculation of these forces non-dimensional coefficients of frontal resistance c_r are determined depending on form of body and its orientation in medium. Value S (mid section) is determined by value of projection of cross section's area on plane, perpendicular to axis of movement.

V - absolute speed of body.

Air density - $\rho \approx 1.3 \text{ kg/m}^3$.

Owing to the fact that sportsman's body changes position in flight, value of mid-section S also changes. With solution of this task we assume averaged variable values of mid-section S and coefficient of frontal resistance C_τ , and, accordingly, coefficients (κ) for 6- intervals of flight time.

First let us determine (position) of coordinate of body mass center in the moment of barrier's overcoming for its rational posture, which, in chosen system of calculation, are to be determined by the following formulas:

$$x_C = \frac{\sum_{k=1}^n m_k x_k}{\sum_{k=1}^n m_k}; \quad y_C = \frac{\sum_{k=1}^n m_k y_k}{\sum_{k=1}^n m_k}$$

$$\sum_{k=1}^n m_k = m - \text{mass of bio-mechanical system,}$$

x_k, y_k – coordinated of center of body mass segments.

We obtain $x_c = 0,0013m$, $y_c = 0,14m$, for system of Descartes coordinates OXY, which is rigidly connected with human body, with starting of counting in anthropometrical point, belonging to top of spine of fifth lumbar vertebra.

Considering position of lower limbs in the moment of barrier's overcoming, minimal rational height of body mass center above barrier in average shall be within 0.3-0.4m.

Because of sportsman body's moving in one of anatomical planes – sagittal, we can compose equations of dynamics in projections on two axes of coordinates: Так как тело спортсмена

$$m\ddot{x}_c = P_x^e; \quad m\ddot{y}_c = P_y^e.$$

Here m - mass of body, \ddot{x}_c, \ddot{y}_c - correspond to projections of acceleration of body mass center, P_x^e, P_y^e - projections of resultant, acting on body

With moving in plane xAy , system of equations can be written in the following way:

$$m\ddot{x} = -R_{cx}; \quad m\ddot{y} = -G - R_{cy};$$

$$m\ddot{x} = -R_c \cos \alpha; \quad m\ddot{y} = -mg - R_c \sin \alpha;$$

$$\cos \alpha = \dot{x}/v; \quad \sin \alpha = \dot{y}/v; \quad v = \sqrt{v_x^2 + v_y^2} = \sqrt{\dot{x}^2 + \dot{y}^2}$$

α – angle between projections, speed of body mass center and vector of its speed, determining signs of projections of forces' vectors on coordinates' axes.

Solution of this task requires integrating of differential equations of movement.

We obtain graph dependences of parameters of hurdling trajectories:

- on absolute initial take off speed of body mass center in front of barrier with assumed take off angle and body mass center's height (see fig.2);
- on take off angle of body mass center with assumed value of initial take off speed (see fig. 3);
- on initial height of body mass center with assumed values of initial take off speed and take off angle (see fig. 4);
- on air resistance forces (see fig. 5);
- on horizontal distances of body mass center's take off from barrier (see fig. 6).

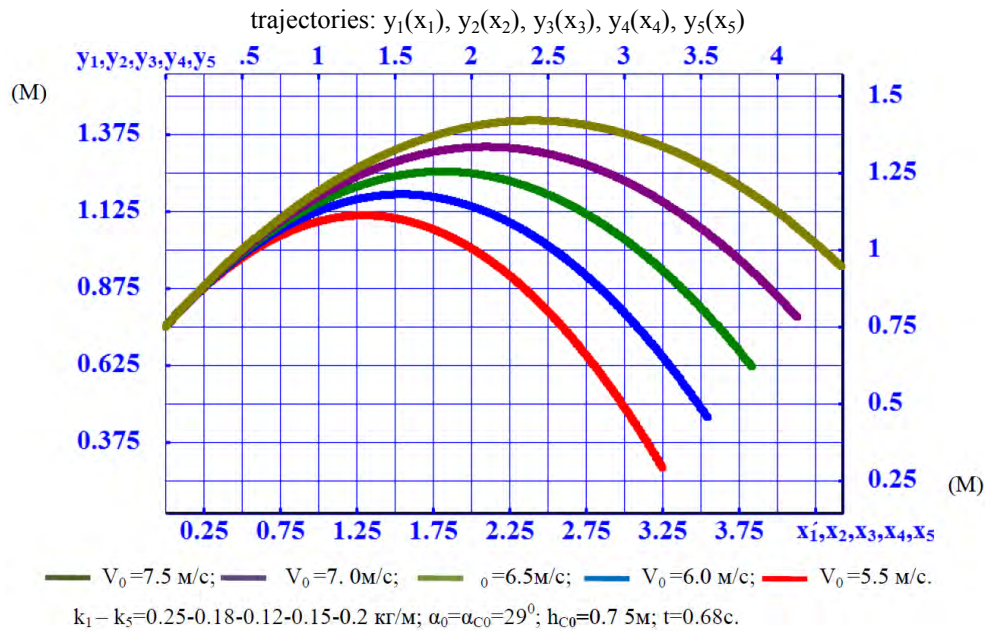


Fig 2. Comparative curve characteristics of trajectories in flight phase, depending on initial speeds of body mass center's take off

Analysis of comparative graphs of trajectories in flight phase, depending on initial speeds of body mass center's take off shows that sportsmen with higher initial take off speed $V_0 = 7.5 \text{ m/sec}$; contact with track after overcoming of barrier at greater distance from barrier that, accordingly, improves results of run. Sportsmen with little initial take off speed $V_0 = 5.5 \text{ m/sec}$; contact with track after overcoming of barrier at less distance that, in some cases can pull off barriers owing to critical height of body mass center above barrier that, accordingly worsens results of run.

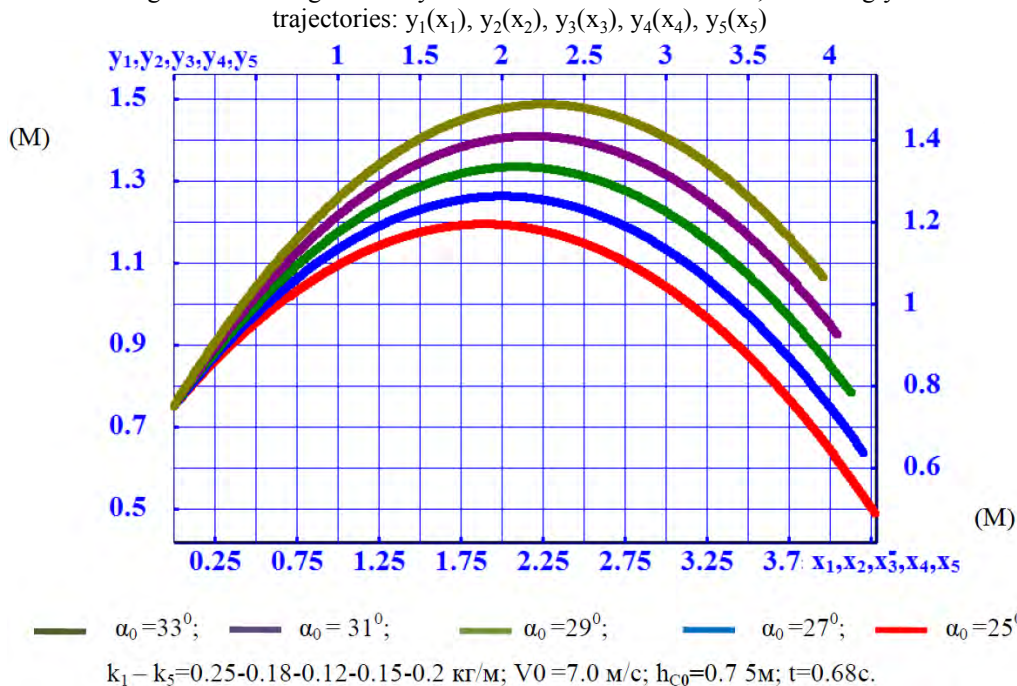


Fig 3. Comparative curve characteristics of trajectories in flight phase, depending on take off angles of body mass center

Analysis of comparative graphs of trajectories in flight phase, depending on take off angles of body mass center shows that choice of the least rational take off angles ($\alpha_0 = 29^\circ$), also significantly improves results. It should be noted that with little take off angles ($\alpha_0 = 25^\circ$) sportsman can not overcome barrier. That means that take off angles shall be chosen in compliance with physical parameters of certain sportsman and initial parameters of take off.

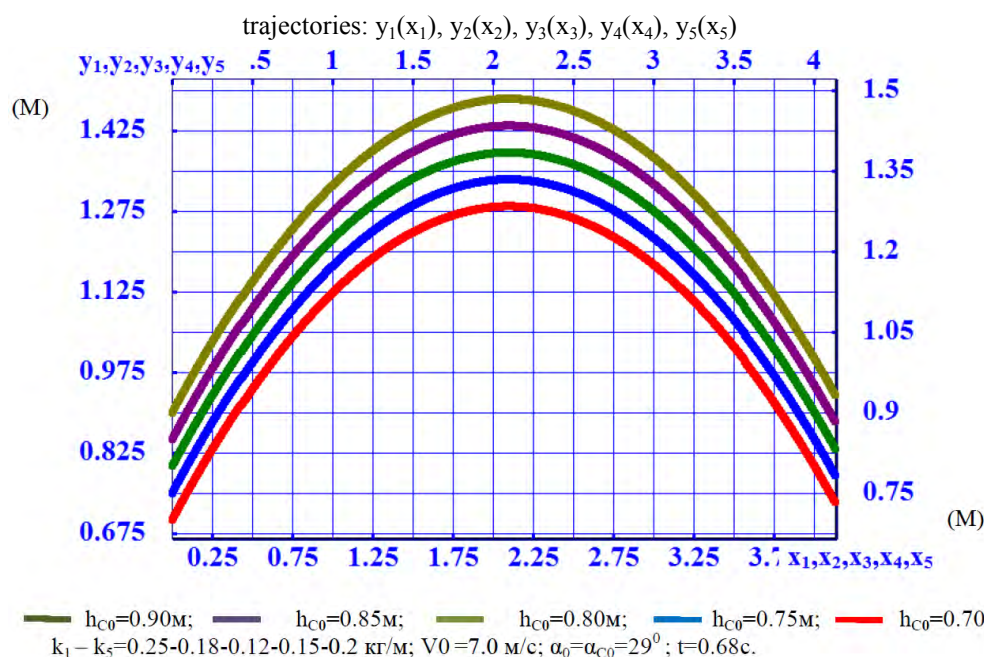


Fig 4.

Comparative curve characteristics of trajectories in flight phase, depending on take off heights of body mass center

Analysis of comparative graphs of trajectories in flight phase, depending on take off height of body mass center with other constant kinematic and geometric characteristics shows that result changes a little.

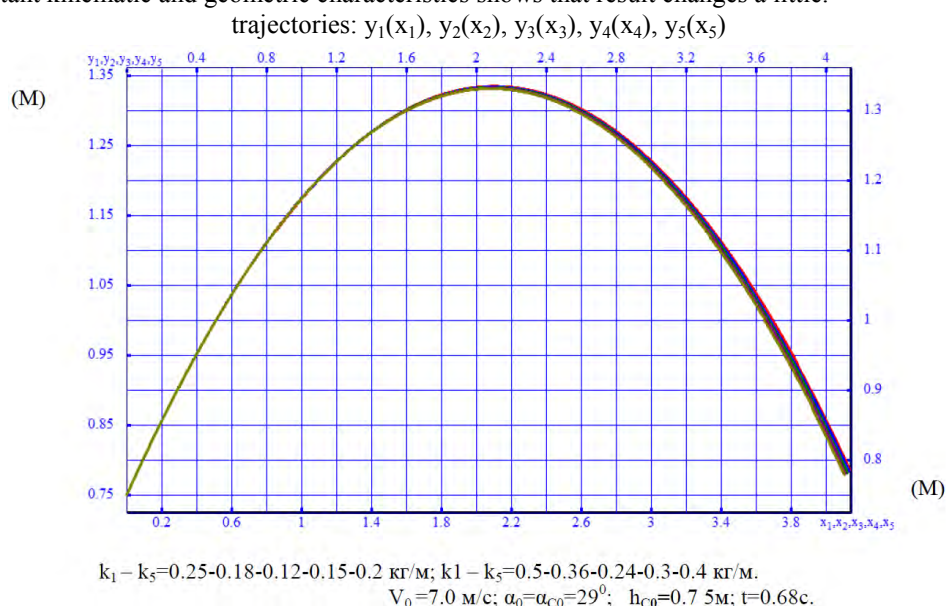


Fig 5. Comparative curve characteristics of trajectories in flight phase, depending on air resistance forces

Analysis of comparative graphs of trajectories in flight phase, depending on air resistance showed that for considered speeds of flight above barriers, air resistance forces influence insignificantly on efficiency. In other cases, for example with frontal wind, this influence can be significant.

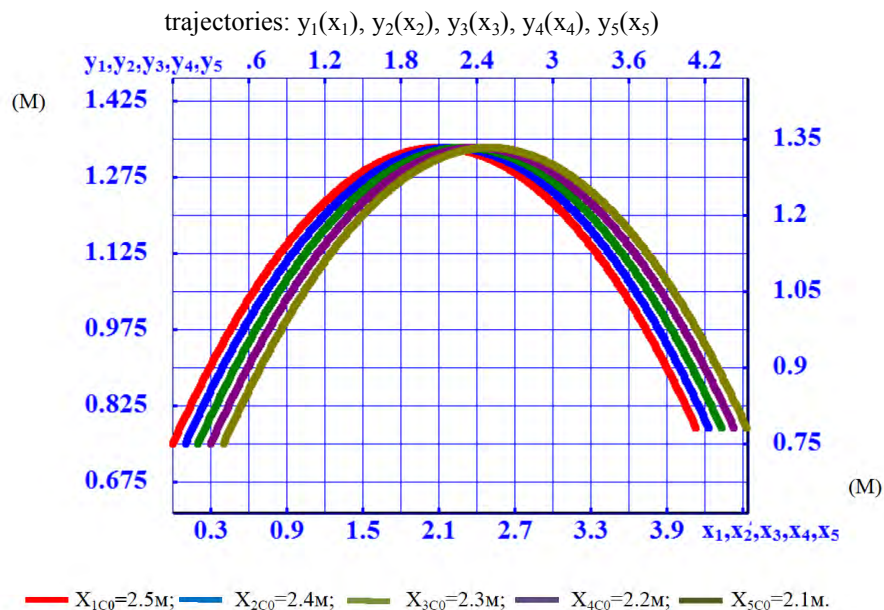
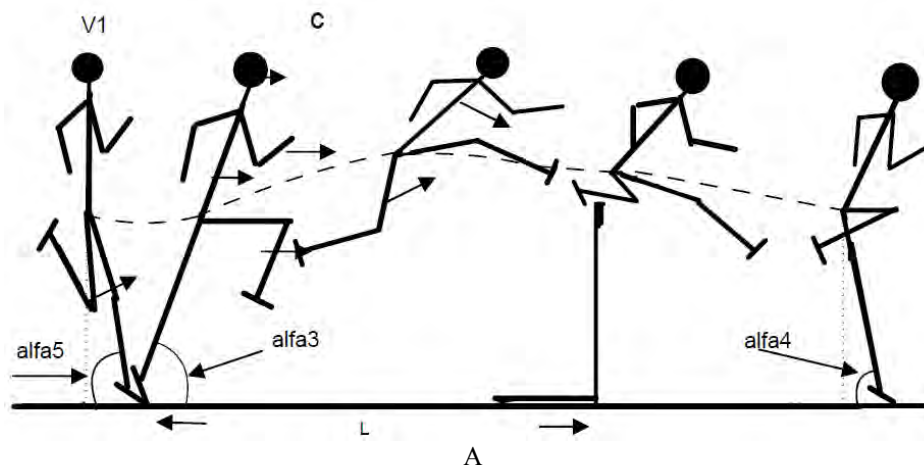


Fig 6. Comparative curve characteristics of trajectories in flight phase, depending on horizontal distance of body mass center take off from barrier

Analysis of comparative graphs of trajectories in flight phase, depending on horizontal distance of body mass center take off from barrier with other constant kinematic and geometric characteristics shows that place of contact with track after flight phase is in reverse proportion to distance of body mass center's take off from barrier. The height of trajectory above barrier also is in reverse proportion to these distances and can have minimal values, with which barriers can be pushed down. with other constant kinematic and geometric characteristics

Thus, using of graph characteristics for determination of hurdling parameters depending on take off speed, take off angle and height it is possible, with its analysis, to correct sportsmen's actions in initial phase and improve result, considering physical parameters and potentials of a sportsman.

Results of theoretical researches to large extent characterize theoretical aspect of barrier step's fulfillment at distance of 100, 110 and 400 meters for men and women (see fig. 7).



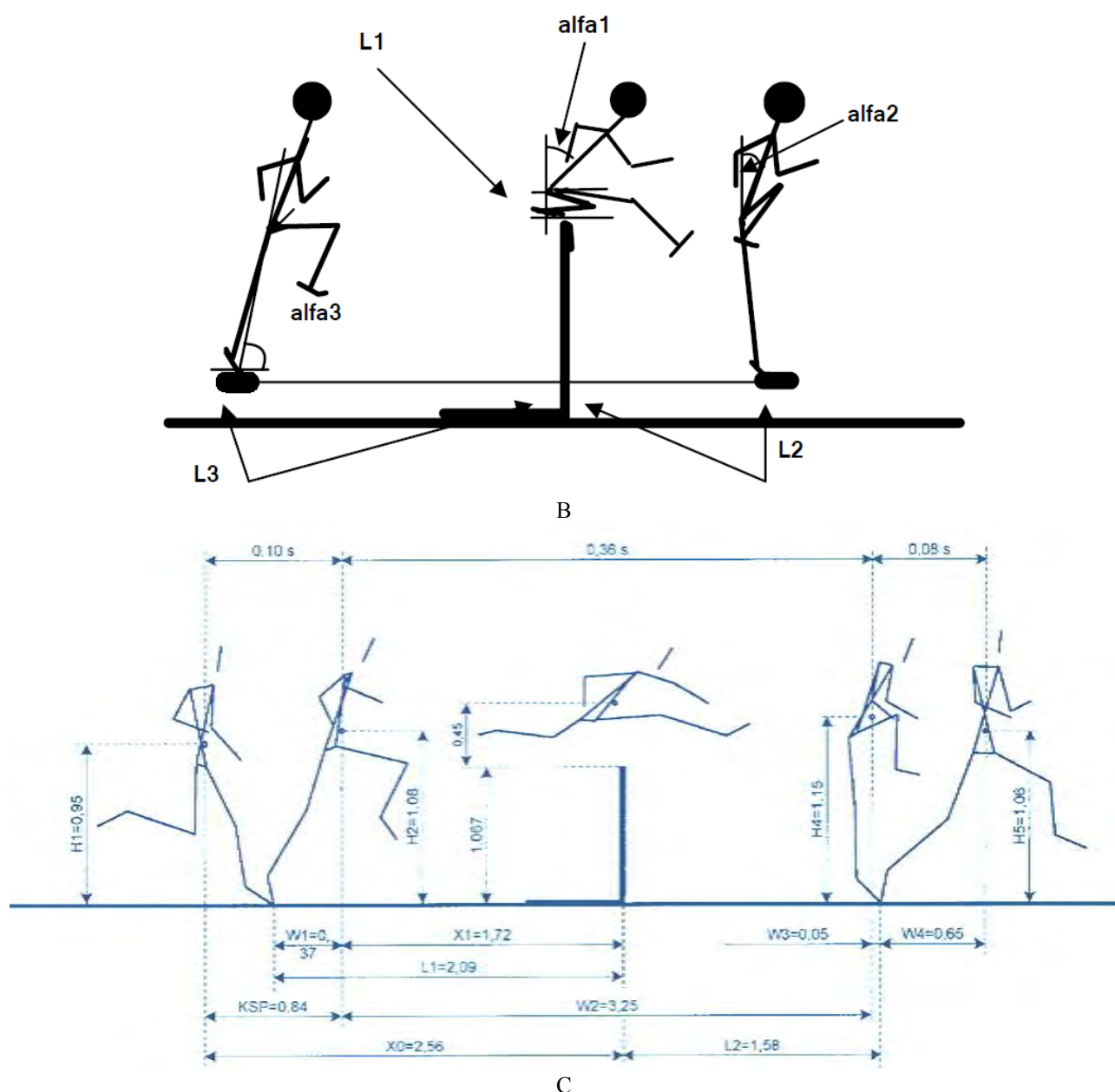


Fig. 7. Kinematic parameters of barrier step (A, B – by data of V.V. Mekhrikadze, L.A. Cherenev, 2008, C – by data of Milan Coh, 2003):

L_1 – distance (cm) from barrier to highest point of GCBM 110 m = 14; 100 m = 37; 400 m, men = 38, women = 39; α_1 – angle of torso bent over barrier: 110 m = 42° , 100 m = 40° , 400 m, men = 32° , women = 30° ; α_2 – angle of torso bent at landing: 110 m = 27° , 100 m = 24° , 400 m, men = 24° , women = 23° ; α_3 – angle of pushing off; L_2 – distance (cm) from barrier to place of landing 1/3 of barrier step or 110 m = 140, 100 m = 100, 400 m, men = 140, women = 115; L_3 – distance (cm) from place of pushing off to barrier 2/3 of barrier step or 110 m = 209, 100 m = 200, 400 m, men = 225, women = 200; V_1 – speed of run before pushing off; C – position of CBM at moment of pushing off; L – distance from place of pushing off to barrier; α_4 – angle of landing; α_5 – angle of leg's positioning.

Parameters of hurdling are characterized by high position of CBM before pushing off, high speed and relatively far place of pushing off that permit: 1- push off under more acute angle and land quicker; 2 – fulfill entering barrier in bent position; 3- prevent from jumping acting. In the proves of barrier step separate parts of body – arms, legs, torso come closer to CBM trajectory and facilitate straight and continuous manner of movement [5]. Such approach permits to create optimal parameters in real movements of a sportsman.

Conclusions:

Thus, the worked out model gives sufficient theoretical understanding of interconnections of movements' different elements, as well as permit to simulate different situations and determine optimal values of kinematic and dynamic characteristics of sportsman's movements. The model permits to correct separate elements of movement directly in the process of training. In analysis of movements' technique it is necessary to consider individual physical condition and anthropometrical characteristics of sportsman's body.

The prospects imply improvement of this model on the base of existing systems of movements' video-analysis.

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COMPETITIVE ACTIVITY OF HIGHLY SKILLED FREESTYLE WRESTLERS AT THE PRESENT STAGE

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Annotation. *Purpose:* to compare competitive activity of highly skilled freestyle wrestlers after making adjustments to the wrestling rules. *Material:* the analysis involved 80 bouts performed by high skilled wrestlers at 2011 World Wrestling Championships (Ankara, Turkey) and 2012 Olympic Games in London (weight categories 84 and 96 kg). *Results:* the resultant technical actions have been analyzed in the standing position performed by highly skilled freestyle wrestlers in major events of the annual cycle for the last three years. The characteristic changes in a competitive activity of highly skilled freestyle wrestlers in the weight categories 84 and 96 kg have been determined. We identified the techniques which were used most frequently in different periods of bout by elite athletes: spurt moving, throwing by knock, pressing, pushing the mat, etc. *Conclusions:* the competitions in the training of athletes are not only a means of controlling the level of preparedness, the process for deciding the winner, but also an important means of improving fitness and sports mastership. In the future, specialists can use these features of competitive activity in determining the overall training strategy of freestyle wrestlers to competitions at various levels.

Keywords: competitive activity, technique, freestyle wrestlers.

Introduction

Permanent increasing of sports records, competition on international sport arena, expansion of sport calendar owing to commercial competitions resulted in intensification of training process and competition functioning, in significant increasing of loads on sportsman's organism [3, 4, 11, 12, 14].

Competition functioning stipulates demonstration and evaluation of sportsmen's abilities in different kinds of sports in compliance with appropriate rules, motion functioning, means of competition contest and evaluation of results [1, 2, 15].

Many specialists have opinion that clear and complete knowledge about content and results of competition functioning in every separate kind of sports are necessary, first of all for the following:

- determination of general strategy of training – selection of means and methods of training, parameters of training loads, using of extra-training factors;
- objectification of sport results in certain competition – possibility of prompt and accurate determination of reasons of success or failure;
- timely correcting of training plans;
- increasing of tactic training's effectiveness, in particular, choosing of tactic variant of participation in certain competition, adequate purpose of participation and potentials of possible adversaries;
- simulation in trainings of actual competitions' conditions [5, 6, 9].

International federation of wrestling (IFW) is actively searching of competition rules, oriented on increasing of dynamic and show character of wrestlers' duel. In 2005 IWF introduced new changes in competition's rules. All duels in every weight category shall start and finish within one day. Wrestler has to conduct 4-6 duels in average during 8-12 hours. Changes took place also in duration of a duel. New formula of a duel is three periods (two minutes each of them) with 30 seconds breaks: at the end of every period winner is to be determined; wrestler, who won two periods, is called a winner and the third period is abolished; pure victory automatically finalizes duel independent on the period, in which it happened.

Recent year specialists [7, 8, 10, 13] have been paying much more attention to studying of competition functioning laws.

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Purpose, tasks of the work, material and methods

The purpose of the work is to compare competition functioning of elite free style wrestlers after correcting of wrestling rules.

The methods of the research: analysis of special scientific-methodic literature, pedagogic observation, methods of mathematical statistics.

Results of the research

We have analyzed 80 duels at world championship 2011 on free style wrestling (Ankara, Turkey) and Olympic Games in London 2012 (weight categories 84 and 96 kg): 4 final duels; 6 duels for 3-5 places; 7 duels of ½ final; 11 duels of ¼ final; 21 duels of 1/8 final; 11 duels of 1/16 final; 12 duels of qualification round; 8 duels of consolation round, which were conducted in compliance with rules, approved before September 2013.

With analyzing of competition functioning we accentuated our attention at technical actions in stance.

In the process of our research we determined that referees evaluated 313 efficient attacking actions in stance: in first period they evaluated 130 attacking actions, in the second – 138, in the third – 45 (see table 1).

Table 1

Efficient technical actions in stance, fulfilled by elite free style wrestlers at world championship 2011 (ANKARA, Turkey) and Olympic Games 2012, in London (weight categories 84 and 96 kg) κ2)

Nos.	Groups of techniques		Period of duels		
			1	2	3
1.	Re-positions by jerk	111	46	44	21
2.	Knock down by pushing	68	28	35	5
3.	Pushing out of mat	68	26	34	8
4.	Re-positions by duck	38	16	15	7
5.	Throws by bent	12	5	4	3
6.	Throws by arching	9	4	4	1
7.	Knock down by twisting	5	3	2	-
8.	Throws by turns	2	2	-	-
Total		313	130	138	45

Analysis of competition functioning of elite free style wrestlers at main competitions of annual cycle witnesses that group of techniques “jerk re-positions”, which are most frequently used by sportsmen in stance, is characterized by the following features of techniques: jerk re-position with hold of legs were fulfilled 54 times, jerk re-positions with hold of namesake shoulder and thigh (torso) – 31 times, jerks with hold of neck from above and shoulder – 18 times, jerks with hold of arm (with undercut) – 8 times.

In the first period, in this group of techniques, the most frequently used ones was re-position with hold of leg – was fulfilled 22 times. At the second place, by frequency of fulfillment, is jerk re-position with hold of namesake shoulder and thigh (torso) – 14 times, at the third place – jerk re-position with hold of neck from above and shoulder – 6 times and technique “jerk re-position with hold of arm (with undercut)” – 4 times.

To some extent different picture was registered in the second period of competition duel. It was necessary to note that, like in the first period, the most frequently used technique was “jerk re-position with hold of leg” (25 times), “jerk re-position with hold of neck from above and shoulder – 9 times; jerk re-position with hold of namesake shoulder and thigh (torso) – 6 times.

Technique “jerk re-position with hold of arm (with undercut) was fulfilled 4 times, while in the third period this technique was not applied by sportsmen at all. Technique jerk re-position with hold of namesake and thigh (torso) was fulfilled by sportsmen in the third period the most frequently – 11 times; jerk re-position with hold of leg – 7 times and jerk re-position with hold of neck from above and shoulder – 3 times.

Knock down by pushing with hold of legs was evaluated by referees 31 times, knock down by pushing with hold of one leg – 28 times, knock down by pushing with hold of arm, torso and step from outside – 5 times; knock down by pushing with hold of arm and namesake leg (mill) – 3 times; knock down by pushing with hold of leg, torso and shin hook from inside – 1 time.

In the first period knock down by pushing with hold of legs was fulfilled 12 times, while knock down by pushing with hold of one leg – 11 times. Knock down by pushing with hold of arm, torso with hook of leg from outside (step from outside) – was fulfilled 3 times. It is also interesting that the least fulfilled in the first period techniques were the following techniques: “knock down by pushing withhold of arm and namesake leg (mill) and knock down by pushing with hold of leg, torso with shin’s hook from inside, which were fulfilled 1 time.

In the second period knock down by pushing with hold of legs was fulfilled 17 times, and with hold of one leg – 14 times. Knock down by pushing with hold of arm, torso with outside hook of leg and knock down by pushing with hold of arm and namesake leg (mill) were fulfilled 2 times.

In the third period sportsmen fulfilled only two techniques: knock down by pushing with hold of one leg – 3 times and knock down by pushing with hold of both legs – 2 times.

From group of techniques “pushing out of mat with hold of leg” was fulfilled 27 times, pushing out of mat with hold of one leg and torso – 25 times, pushing out of map with hold of arm, torso (rest on breast) – 9 times, pushing out of mat with hold of legs – 4 times, pushing out of mat with hold of neck from above and shoulder – 3 times.

Analyzing frequency of sportsmen’s application of techniques “pushing out of mat” we determined that in the first period pushing out of mat with hold of leg and torso was fulfilled 12 times; pushing out of mat with hold of one leg – 6 times; pushing out of mat with hold of arm and torso – 4 times; pushing out of mat with hold of legs – 3 times and pushing out of mat with hold of neck from above and shoulder – 1 time.

In the second period sportsmen applied pushing out of mat with hold of one leg – 19 times, pushing out of mat with hold of leg and torso – 10 times, pushing out of mat with hold of arm and torso – 5 times.

In third period pushing out of mat with hold of one leg was fulfilled *by elite sportsmen 2 times*, pushing out of mat with hold of one leg and torso – 3 times, pushing out of mat with hold of both legs – 1 time, pushing out of mat with hold of neck from above and shoulder – 2 times.

From group of techniques “duck re-position with hold of torso” was most frequently used by free style elite wrestlers – 15 times, duck re-position with hold of one leg – 14 times, duck re-position with hold of both legs – 7 times, duck re-position with hold of arm and thigh – 2 times.

Detail analysis of first period of competition duels permitted to range this group’s techniques by frequency of their fulfillment in the following way: 1- duck re-position with hold of torso (7 times); 2 – duck re-position with hold of one leg (5 times); 3 – duck re-position with hold of arm and thigh (2 times each). In the second period the most frequently used techniques were duck re-position with hold of torso and duck re-position with hold of one leg, which were fulfilled 6 times each. Duck re-position with hold of both legs was fulfilled 3 times, while duck re-position with hold of both legs and duck re-position with hold of torso were fulfilled by sportsmen 2 times each.

The most frequently used techniques of group “throws in bent” was throw in bent with hold of both legs, which was fulfilled 6 times. Throw in back bent with hold of one leg was applied 4 times and throw in bent with hold of opposite arm and leg and throw in bent with hold of opposite arm and thigh from aside were fulfilled 1 time each.

In the first period throw in bent with hold of both legs and throw in back bent with hold of opposite arm and leg were fulfilled 1 time each. Analyzing the second period we determined that sportsmen used throw in bent with hold of one leg – 3 times and with hold of opposite arm and thigh – one time. In the third period sportsmen fulfilled throw in bent with hold of both legs – 1 time and throw in bent with hold of 1 leg – 2 times.

In group of techniques “throws in arching” the most frequent were throws in arching with hold of neck from above and shoulder – 4 times; throws in arching with hold of torso from behind – 3 times and throws in arching with hold of arm and torso from aside throws in arching with hold of arm and torso with embracing – 1 time each.

In the first period throw in arching with hold of neck from above and shoulder, throw in arching with hold of torso from behind, throw in arching with hold of arm and torso from aside and throw in arching with hold of arm and torso with embracing were fulfilled 1 time each of them. In the second period the most frequently used techniques were throw in arching with hold of neck from above and shoulder (3 times) and throw in arching with hold of torso from behind (1 time). Distinctive feature of the third period of competition duel is that sportsmen used only one technique of this group - throw in arching with hold of torso from behind (1 time).

From group of techniques “knock down by twisting”, which were efficiently evaluated by referees at such competitions we determined the following peculiarity: knock down by twisting with hold of arm and torso was fulfilled 2 times; knock down by twisting with hold of both arm and embracing from inside – 1 time; knock down by twisting with hold of neck from above and shoulder – 1 time; knock down by twisting with hold of neck from above and arm from below – 1 time.

Detail analysis of first period permitted to determine that sportsmen fulfilled 2 times knock down by twisting with hold of arm and torso and 1 time - knock down by twisting with hold of both arms and embracing from inside. In the second period wrestlers applied knock down by twisting with hold of neck from above and shoulder 1 time). Analysis of the third period of competition duel witnesses that this group’s techniques were not applied at all by sportsmen.

Analysis of the obtained data points at the fact that in group of techniques “throws by twisting”, techniques with holding of namesake arm and leg and with hold of arm were used 1 time each and only in first competition period. In second and third competition periods sportsmen did not apply these techniques.

In May 2013, in Moscow, at unscheduled congress of IFW there were entered substantial corrections in rules of wrestlers.

These changes touched upon the following moments:

- Duration of duel shall be 2 periods (3 minutes each of pure time for adult wrestlers and junior) and 2 periods (2 minutes of pure time for cadets) with 30 seconds breaks between periods;
- resulting points will be total by sum of periods;
- the procedure of determination of passivity also changed – for passive behavior on mat sportsman, first, will receive two oral remarks; after second remark he will have 30 seconds for fulfillment of a technique and if he fails it, his adversary will receive one point; in Graeco-Roman wrestling this 30 second period is not applied. More active wrestler will be offered a choice: to continue duel in stance or in “par terre”;
- points for re-positioning of adversary in “par-terre” changed from one to two points;
- technical advantage, after which duel shall be stopped, will be 7 points.

At world championship on free style wrestling, which took place in the period from September 16th to September 22nd (in Budapest, Hungary), competition functioning of wrestlers was evaluated by referees in compliance with new rules.

We have analyzed 51 duels in weight categories 84 and 96 kg: 2 final, 4 duels for 305 places; 4 duels for 1/2 final; 8 duels of 1/4th final; 7 duels of 1/8th final; 19 duels of 1/16th final; 5 duels of qualification round and 2 duels of consolation round (weight categories 84 and 96 kg).

We have determined that referees evaluated 160 efficient actions in stance. It is interesting that both in first and in second periods they evaluated 80 attacks (50%) (see table 2).

Table 2

Efficient technical actions in stance, fulfilled by elite free style wrestlers at world championship, 16-22.09.2013 (Budapest, Hungary) (weight categories 84 and 96 kg) κ2)

Nos.	Groups of techniques		Period of duels	
			1 st period	2 nd period
1.	Jerk re-positions	69 (43,1%)	31 (38,8%)	38 (47,5%)
2.	Knock down by pushing	43 (26,9%)	23 (28,8%)	20 (25%)
3.	Duck re-positions	8 (5%)	4 (5%)	4 (5%)
4.	Throws by arching	5 (3,1%)	1 (1,2%)	4 (5%)
5.	Squatting re-positions	4 (2,5%)	2 (2,5%)	2 (2,5%)
6.	knock down by twisting	3 (1,9%)	3 (3,8%)	0
7.	Throws in bent	2 (1,2%)	1 (1,2%)	1 (1,2%)
8.	Pushing out of mat	26 (16,3%)	15 (18,6%)	11 (13,8%)
Total 160 (100%)			80 (100%)	80 (100%)

Analysis of competition functioning of free style elite wrestlers witnesses that group of techniques “jerk re-positions”, which are most frequently used by sportsmen in stance (69 times), characterized by the following peculiarities of technical actions: jerk re-positions with hold of legs were fulfilled 32 times, jerks re-positions with hold namesake shoulder and thigh (torso) – 24 times, jerk re-positions with hold of neck from above and shoulder – 13 times.

In this group of techniques in first period the most frequently used technique was jerk re-position with hold of leg, which was fulfilled 14 times.

On the second place there is technique jerk re-position with hold of namesake shoulder and thigh (torso) – 13 times; on the third place – jerk re-position with hold of neck from above and shoulder – 4 times. In the second period the picture of competition duel was practically identical. On the first place, by frequency of application there is a technique – jerk re-position with hold of leg, which was fulfilled 18 times; on the second place – jerk re-position with hold of namesake shoulder and thigh (torso) - 11 times; on the third place – jerk re-position with hold of neck from above and shoulder – 9 times.

The second, by frequency of application, are techniques of knock down by pushing, which were fulfilled by elite sportsmen at world championship 43 times (26.9%).

Knock down by pushing with hold of one leg was evaluated by referees 20 times, knock down by pushing with hold of two legs – 18 times, knock down by pushing with hold of arm, torso and outside hook of leg – 2 times, knock down by pushing with hold of leg, torso and inside shin hook – 2 times, knock down by pushing with hold of arm and namesake leg (mill) – 1 time.

In the first period wrestlers fulfilled knock down by pushing with hold of two legs 6 times. It is interesting that sportsmen fulfilled less of all knock down by pushing with hold of arm, torso and outside hook, knock down by pushing with hold of leg, torso and inside shin hook as well as knock down by pushing with hold of arm, namesake leg (mill), which were fulfilled 1 time.

In the second period the picture of competition duel was a little bit different. Elite wrestlers fulfilled the most frequently knock down by pushing with hold of two legs – 12 times and knock down by pushing with hold of one legs 6 times. Knock down by pushing with hold of arm, torso and outside hook of leg as well as knock down by pushing with hold of one leg, torso and inside shin hook were applied, like in first period – 1 time each. Knock down by pushing with hold of arm and namesake leg (mill) did not applied by sportsmen in the second period at all.

From group of techniques “duck re-positions” elite free style wrestlers used the most frequently the following: duck re-position with hold of leg – 5 times; duck re-position with hold of torso – 2 times; duck re-position with hold of two legs – 1 time.

Detail analysis of the first period of competition duel witnesses that in the first period the most frequently were used the following techniques: duck re-position with hold of leg (2 times), duck re-position with hold of torso (1 time), duck re-position with hold of two legs (1 time).

In the second period the most frequently used technique was duck re-position with hold of one leg, which was applied 3 times. Duck re-position with hold of torso was applied only one time.

In group “throws in arching” the most frequently used techniques were the following: throws in arching with back hold of torso – 2 times, while such techniques as throws in arching with hold of arm and torso from aside, throws in arching with hold of arm and torso with embracing as well as throws in arching with hold of arms were fulfilled by elite sportsmen 1 time each.

With it, it is necessary to pay attention to the fact that in the first period of competition duel there was applied only one throws in arching with hold of arm and torso with embracing. Accordingly, in the second period throws in arching with back hold of torso were fulfilled 2 times and throws in arching with hold of arms and torso from aside were fulfilled only 1 time.

Analysis of frequency of elite sportsmen’s fulfillment of re-positions by squatting witnesses that during all duel this group’s techniques were fulfilled 4 times. It should be noted that like in the first period of competition period in the second one re-position by squatting with hold of leg and re-position by squatting with hold of legs were fulfilled 1 time each.

From group of techniques “knock down by twisting” the most frequently applied by elite wrestlers were the following techniques: knock down by twisting with hold of neck from above and shoulder – 2 times, knock down by twisting with hold of arm and torso – 1 time.

It is also interesting that techniques of this group were applied by elite sportsmen only in the first period of competition duel.

From group of techniques “pushing out of mat”, pushing out of mat with hold of leg was fulfilled by wrestlers 8 times, pushing out of mat with hold of arm from above – 6 times, pushing out of mat with hold of leg and torso – 5 times, pushing out of mat with hold of torso – 3 times, pushing out of mat with hold of two legs – 2 times, pushing out of mat with hold of neck from above and shoulder – 2 times.

Analyzing frequency of sportsmen’s application of this group’s techniques we determined that in the first period pushing out of mat with hold of one leg was fulfilled 6 times, pushing out of mat with hold of arm from above – 3 times, pushing out of mat with hold of leg and torso – 4 times, pushing out of mat with hold of torso- 2 times.

In the second period sportsmen used pushing out of mat with hold of arm from above – 3 times, pushing out of mat with hold of leg – 2 times, pushing out of mat with hold of two legs – 2 times, pushing out of mat with hold of neck from above and shoulder 2 times and pushing out of mat with hold of torso and with hold of leg and torso – 1 time each.

Conclusions:

Generalizing views of many leading specialists in the field of sport science we can state that sport competitions in Olympic sports are central element, which determine all system of organization, methodic and training of sportsmen for their efficient competition functioning.

Analysis of special scientific-methodic literature permits to affirm that in system of sportsmen’s training competitions are not only a mean of control of fitness’s level, mean of determination of a winner, but also an important mean of improvement of fitness’s level and sportsmanship.

In the process of our research we have determined specific features of competition functioning of elite free style wrestlers of weight categories 84 and 96 kg at main competitions of annual cycle for recent three years.

The prospects of further researches imply that determined by us specific features of competition functioning can be used, in the future, by coaches for determination of general strategy of free style wrestlers’ training for competitions of different level.

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TYPICAL MISTAKES, MADE BY THE CADETS, MASTERING THE SUBMISSION LOCKS, OF THE HIGHER EDUCATIONAL ESTABLISHMENTS OF THE MINISTRY OF INTERNAL AFFAIRS OF UKRAINE

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Annotation. *Purpose:* to define the typical mistakes made by the cadets, mastering the submission locks, of the higher educational establishments of the Ministry of Internal Affairs of Ukraine. *Results:* with the help of ranking the data analysis of the scientific-methodological-literature shows that the specialists have been performing the search of sources during long period of time, specifying the possibility of intensification of physical actions teaching. The typical mistakes made by the cadets, mastering the submission locks, have been identified. They are the following: hand's bend behind one's back by "dive", outward lever, hand's bend behind one's back by "jerk", hand's bend behind one's back by "lock", inwards lever of the arm. It was proved, that improvement of the educational process on the discipline "Special Physical Training" in higher educational establishment of the Ministry of Internal Affairs of Ukraine requires the search, defining and implementation of effective methods and technologies of teaching the techniques of hand-to-hand fighting, helping to achieve high professional level of the cadets. *Conclusions:* the improvement of teaching methods with the position of advanced theoretical conditions about the processes of movements regulation give the opportunity of wide use in practice the professional-applied physical training of the higher educational establishments of the Ministry of Internal Affairs of Ukraine the various innovative approaches to the teaching and planning the curriculum program in special physical training.

Key words: hand-to-hand, fighting, cadets, special, physical, training.

Introduction

Hand to hand fighting is one of the most complex kinds of martial arts because it includes technical arsenal of practically all kinds of martial arts, in which it is permitted to use controlled blows, throws, holds, submission holds and locks depending on certain situation of a duel [2-7].

Main difficulties, which are met by coaches, are questions of training methodic of trainees, problems of training means' selection, which would facilitate increasing of effectiveness of their training process [1, 8, 14, 15, 16-18].

Especially urgent is methodic of training of submission holds in hand to hand fighting at trainings on cadets' special physical training. Submission holds are actions, oriented on causing pain or traumas of adversary with active counter-joints techniques or with influencing on vitally important organs and parts of body [9, 11].

In opinion of A.Z. Yestemesov [10] it is necessary to mark out the following specificities of techniques' training in hand to hand fighting:

- In existing methodic of hand to hand fighting training two main approaches are used: the first, based on sport sambo and ju-do training's methodic, where key role is played by throws and submission holds, while techniques of blows with different parts of body plays secondary role.; the second is based on karate methodic, where, on the contrary, main accent is made on blows by different parts of body, while throws play secondary role;

- System of hand to hand fighting can be both of sport and applied character. In both cases quality of techniques' fulfillment depends on influence of extreme situations, which are rather frequent for trainees. Depending on wrestler's condition in existing practice of work, there are marked out up to eleven variants of wrestler's state and appropriate methods of overcoming this situation, i.e. increasing of organism's stress-resistivity;

- In training of hand to hand fighting techniques not only mastering of psychological self-regulation methods is of extreme importance but also mastering of control over own physical efforts. The matter is that value of physical efforts, required for realization of a technique, can be the cause of traumatism at trainings. In this connection at trainings it is important to follow principle of "optimal efforts" and try to conduct technique with maximal accuracy [10].

Formation of scientifically grounded content and methodically justified sequence of hand to hand fighting's training, realized on the base of fundamental theoretical and scientific principles permitted for A.Z. Yestemesov [10], to determine the following principles from methodic point of view. Videlicet, control over training of hand to hand fighting trainings and professional-applied fitness of the trainees shall stipulate:

- Organization of clear and logical system of evaluations (evaluation of fitness's structure, evaluation of trainee's condition and evaluation of character of the used load);
- Determination of logical sequence of hand to hand fighting's training, which shall be considered and embedded in content of perspective, current and operative plans of training;
- Creation of system of control over physical load, applied at hand to hand fighting trainings and based on registration of time, paid to kinds of training and on consideration of level of its specialization.

For increasing of effectiveness of training process of cadets of Russian MHA higher educational establishments they use the so-called block principle, according to which mastering of motion actions is carried out in interconnection with formation of professionally important physical qualities. This ensures holistic readiness for functioning, arresting of actively resisting criminals [11].

The first block of trainings is oriented on formation of understanding and skills in demonstration of different submission holds on not resisting partner.

Combat techniques shall be understood as system of techniques and blows, used in hand to hand fighting.

The second block of trainings is oriented on mastering of already familiar techniques owing to frequent repetition of the latter and mastering of combinations of these techniques with dozed resistance of partner.

The third block is oriented on practical realization of the mastered material in conditions, maximally approximated to real; situations of fighting and power arresting of criminal.

In opinion of A.V. Shyshkina effective organization of motion functioning's training stipulates creation of artificial conditions for cognition process. This author applied the following methodic means in his work:

1. Attracting of trainees to independent analysis of video-record of movements' techniques with the help slowing, stoppage and multiple repetition of video record.

2. Verbal reports on understanding of the mastered movements and description of muscular sensations, which appear with this movement.

3. For organization of detail conscious control of movements' technique specialists were offered to attract attention of trainees to fulfillment of techniques' elements in the following way: they should put the task of observation, with it was pointed what requires attention; vivid comparisons were used, character of movements was stressed by intonation [13].

V.V. Kolesnikov in his work [11] determined ways for increasing of effectiveness of hand to hand fighting techniques' training for cadet of higher educational establishments of MHO of Ukraine on the base of individualization of SPT. In specialists' opinion, in order to improve effectiveness of training process and hand to hand fighting techniques it is necessary to consider coordination level of cadet. With it, as the author notes, special attention should be paid to progressing of space and time parameters of motion technique.

Analysis of experimental data about effectiveness of different hand to hand fighting tactics permitted for A.N. Kochergin [12] to specify two trends. First, probability of victory is substantially higher, is cadet realizes aggressive-attacking tactic. Secondly, advantage of attacking tactic reduces with rising of adversary's level of fitness.

In specialists' opinion, in methodic of hand to hand fighting's training of military and law enforcement officers there shall be realized active, attacking orientation of tactic, ability to take initiative from the first seconds, continuously attack and not to give adversary any chance for his attacking actions. This orientation was formulated by A.N. Kochergin [12] as principle of power domination.

The work has been fulfilled in compliance with combined plan of SRW ion sphere of physical culture and sports for 2011-2015 of Ministry of education and science, youth and sports of Ukraine by topic 3.7. "Improvement of bio-mechanical technologies in physical education and rehabilitation, considering individual features of human motor system", state registration number: 0111U001734.

Purpose, tasks of the work, material and methods

The purpose of the work is to determine typical mistakes, which are made by cadets of MHO HEEs of Ukraine when mastering submission holds.

The methods of the research: analysis of special scientific-methodic literature, pedagogic observations, pedagogic experiment, quality metering, methods of mathematical statistics.

Results of the research

In experiment we used the method of experts' evaluations. This method was chosen for ranging of typical mistakes, made by cadets with mastering of submission holds and locks. For this purpose we conducted expertise with method of preferences.

Regarding submission hold "Bending of arm behind back" it is necessary to note that experts' opinions about typical cadets' mistakes distributed in the following way: 1. Adversary (criminal) was not forced to lose balance; 2. When bending of arm behind back there is no push of elbow from above downward under angle of 45 degrees of the held criminal's arm; cadet does not fulfill left (right) leg step ahead; 3. Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside. 4. Wrong hold of forearm and wrist, right wrist of your hand shall be below left; 5. Holds with right and left hands are not simultaneous (right wrist shall be below left); 6. Too slow "duck" under criminal's arm without putting left (right) leg to stand aside of adversary; 7. Relaxing kick to grown or supporting leg was not made (see table 1).

Analyzing technique "outside arm-bar", experts ranged the following typical mistakes: 1. Twisting of forearm and wrist of the held arm under angle 90° outside does not fulfilled. 2. Step with left (right) leg back with turn by 90° after relaxing kick does not fulfilled. 3. Hold of criminal's wrist is executed wrongly. 4. Step with left (right) leg ahead-aside does not fulfilled. The stepping leg shall be half bent in knee joint. 5. "Attacker" does not make relaxing kick in grown or supporting leg (see table 2).

Table 1

Mistakes, made by cadets with fulfillment of submission hold "Bending of arm behind back with "duck"

Nos	Submission hold "Bending of arm behind back with "duck". Technique is fulfilled on right arm.	Place
1.	Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside	3
2.	Wrong hold of forearm and wrist, right wrist of your hand shall be below left	4
3.	Holds with right and left hands are not simultaneous (right wrist shall be below left)	5
4.	Adversary (criminal) was not forced to lose balance	1
5.	Relaxing kick to grown or supporting leg was not made	7
6.	Too slow "duck" under criminal's arm without putting left (right) leg to stand aside of adversary	6
7.	Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside.	2

Table 2

Mistakes, made by cadets with fulfillment of submission hold "Outside arm-bar"

Nos	Submission hold "Outside arm-bar". Technique is fulfilled on right arm. With holding of left adversary's arm the sequence of actions is the same but position of arms and legs change.	Place
1	Step with left (right) leg ahead-aside does not fulfilled. The stepping leg shall be half bent in knee joint	4
2	Hold of criminal's wrist is executed wrongly	3
3	"Attacker" does not make relaxing kick in grown or supporting leg	5
4	Twisting of forearm and wrist of the held arm under angle 90° outside does not fulfilled	1
5	Step with left (right) leg back with turn by 90° after relaxing kick does not fulfilled	2

At the same time when regarding submission hold "Bending of arm behind back with jerk" experts noted the following typical mistakes, made by cadets: 1. Adversary (criminal) was not forced to lose balance; 2. Holds with right and left hands are not simultaneous; 3. Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside; 4. Relaxing kick to grown or supporting leg was not made (see table 3).

Table 3

Mistakes, made by cadets with fulfillment of submission hold "Bending of arm behind back with jerk"

Nos	Submission hold "Bending of arm behind back with jerk"	Place
1	Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside;	3
2	Holds with right and left hands are not simultaneous	2
3	Relaxing kick to grown or supporting leg was not made	4
4	Adversary (criminal) was not forced to lose balance	1

Also experts' opinion about mistakes, made by cadets, when fulfilling submission technique "Bending of arm behind back with "lock" is interesting. They ranged typical mistakes in the following way: 1. Wrong "lock" hold of arm; 2. Forearm is not pressed to torso; 3. "Unlocking" starts earlier than adversary loses balance; 4. Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside; 5. Relaxing kick to grown or supporting leg was not made (see table 4).

Table 4

Mistakes, made by cadets with fulfillment of submission hold "Bending of arm behind back with "lock"

Nos	Submission hold "Bending of arm behind back with "lock"	Place
1	Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside;	4
2	Wrong "lock" hold of arm	1
3	Relaxing kick to grown or supporting leg was not made	5
4	Forearm is not pressed to torso	2
5	"Unlocking" starts earlier than adversary loses balance	3

In experts' opinion, when mastering submission hold "Inside arm-bar" cadets made the following typical mistakes: 1. Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside. Leg shall be half bent in knee joint. 2. Wrong hold of arm. 3. Left (right) leg is put near left (right) leg of adversary; 4. Shoulder joint of adversary's right (left) hand is not blocked; 5. Relaxing kick to grown or supporting leg was not made; 6. Adversary (criminal) was not forced to lose balance 7. Finalizing pressing of wrist of the held arm is not executed (see table 5).

Table 5

Mistakes, made by cadets with fulfillment of submission hold "Inside arm-bar"

Nos	Submission hold "Inside arm-bar". Technique is fulfilled on right arm. With holding of left adversary's arm the sequence of actions is the same but position of arms and legs change.	Place
1.	Left (right) leg step to adversary is fulfilled wrongly; it shall be fulfilled under angle of 45 degrees ahead-aside. Leg shall be half bent in knee joint.	1
2.	Wrong hold of arm.	2
3.	Relaxing kick to grown or supporting leg was not made	5
4.	Adversary (criminal) was not forced to lose balance	6
5.	Shoulder joint of adversary's right (left) hand is not blocked	4
6.	Finalizing pressing of wrist of the held arm is not executed	7
7.	Left (right) leg is put near left (right) leg of adversary	3

In table 6 we present degree of experts' opinions accordance with ranging of typical mistakes, made by cadets when mastering submission holds.

Table 6

Degree of experts' opinions accordance with ranging of typical mistakes, made by cadets when mastering submission holds. (n=20)

Nos	Techniques	Coefficient of concordance
1.	Submission hold "Bending of arm behind back with "duck"; to be fulfilled on right hand	0,9
2.	Submission hold "Outside arm-bar". Technique is fulfilled on right arm. With holding of left adversary's arm the sequence of actions is the same but position of arms and legs change	0,9
3.	Submission hold "Bending of arm behind back with jerk"	0,8
4.	Submission hold "Bending of arm behind back with "lock"	0,9
5.	Submission hold "Inside arm-bar". Technique is fulfilled on right arm. With holding of left adversary's arm the sequence of actions is the same but position of arms and legs change.	0,8

Conclusions:

Training of hand to hand fighting principles in the process of special physical training of cadets of MHO of Ukraine HEEs, regarding it both: as kind of sport and as special applied training, faces with substantial contradiction. On the one hand there published a lot of special literature, devoted to hand to hand fighting training. On the other hand, methodic of hand to hand fighting training has been still being based on practical experience but not on fundamental scientific researches. If to regard questions, touching on introducing of modern informational systems, oriented on improvement of effectiveness of trainings, in training process, we have to state that they are practically absent.

In the process of stating experiment we determined typical mistakes, made by cadets of MHO of Ukraine HEEs when mastering submission holds and locks.

The prospects of further researches imply improvement of training methods, basing on advanced theoretical principles about regulation of movements, which are rather promising for professional-applied physical training of cadets of MHO HEEs of Ukraine; basing on different innovative approaches to training and planning of curriculum on special physical education and their experimental foundation.

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CONTROL SYSTEM IMPROVEMENT OF QUALIFIED BOXERS BASED ASSESSMENT SYSTEM CHANGE REACTION CARDIORESPIRATORY DURING THE IMMEDIATE PREPARATION FOR COMPETITION

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Annotation. *Purpose:* Experimental verification and justification of possible practical applications of the method of assessing changes in the functional state of the boxers, based on heart rate variability and spontaneous breathing. In the future, use the results to improve the management of physical exercise in shock and competitive microcycle. *Material:* The study involved 12 masters of sport of boxing. Instrument was used Sacra. *Results:* The analysis of heart rate variability and spontaneous respiration showed individual differences changes centile distribution indicators in the management processes of fatigue - recovery cycle training sessions. *Conclusions:* The differences in the functional state of the body before exercise, during and between training sessions aftereffect. Showing differences readiness athletes to training sessions, the reaction of the organism to the load activation of redox reactions.

Keywords: functional, state, variability, heart rate, spontaneous, breathing.

Introduction

Up-to date methods of evaluation of sportsmen's functional potentials are based on two main approaches. The first approach is connected with evaluation of functional provisioning of sportsmen's workability. These measurements are carried out in the process of fulfillment of tests. They reflect quantitative and qualitative changes of sportsmen's general and special physical fitness [7]. This approach permitted to receive solid results, which facilitated to formation of scientific-methodic principles of control of sportsman's training, including in boxing [8, 14]. The second approach is connected with estimation of sportsmen's functional condition in certain conditions of sport trainings, for example with preparation for start or in recreational period after intensive training or competition loads [6]. Systemizing of such approaches permitted to obtain serious results, which permitted to form scientific-methodic principles of control of sportsmen's training, oriented on development of different sides of sportsmen's functional potentials [12, 13], as well as on optimization of organism's tiredness and recreation in training cycles [2, 5].

At the same time there appeared understanding of the fact that received information about adaptation changes in sportsman's organism in trainings can be significantly increased on the base of analysis of quantitative and qualitative changes of correlation "doze-effect", of influence of specially targeted physical loads [1]. They are especially informative criterion of correspondence of achieved and desired trainings' effects; they reveal the sense of integration of external and internal loads' sides, reflect inter-connections between workability, organism's reactive abilities and achieved training results [9].

Thus, it permits to regard quantitative and qualitative criteria of "doze-effect" correlations, as well as achieved load's parameters, in system of improvement of means and methods of highly qualified sportsmen's training [3, 4, 15], as well as to use them for working out of new methods of control of qualified sportsmen's training process [11].

Especially it is important to work out such criteria for certain conditions of sport trainings, considering their target orientation. In certain case it can be actual to work out criteria of complex evaluation of sportsman's pre-start fitness, of organism's responses to loads and level of recreational processes' activation. New criteria can be based on evaluation of boxers' functional condition in the morning, in day of training with high load, just after such training and next morning.

Purpose, tasks of the work, material and methods

The purpose of the work is experimental testing and foundation of possibility of practical application of sportsmen's functional condition's evaluation by indicators of heart beats rate and spontaneous breathing for improvement of physical loads' regulation in training micro-cycles.

The work has been fulfilled as per combined plan of SRW in field of physical culture and sports for 2011-2015 by topic 2.9. "Individualization of training process of qualified martial arts sportsmen".

The methods and organization of the research. 12 qualified sportsmen (masters of sports) participated in the researches. They belonged to weight categories 50.802 – 86.01 kg.

Analysis of variability of heart beats frequency (HF) and respiratory system was fulfilled with the help of device "SAKR" [7]. We analyzed indicators, which reflected total capacity of HF variability and general condition of regulating functioning of autonomous nervous system – TP. TP indicators characterized peculiarities of reconstructions of cardiac functioning's vegetative provisioning under influence of intensive physical loads as well as its functional reserve's condition. We also analyzed indicators of sympathetic (LF) and para-sympathetic regulations of HF. Simultaneously with heart rate we calculated spectral characteristics of air flow speed and spiro-gram of averaged breathing cycle. For spiro-gram of averaged breathing cycle we calculated: time of inhale (T_{inh}), time of exhale (T_{exh}), speed of exhale (BV/T_{exh}), breathing volume (BV). Spectral characteristics of volume speed of air flow were calculated

by three main spectral components: especially low-frequency VLF, low-frequency – LF, high-frequency – HF and total variability of volume speed of air flow – TP.

The researches were conducted in period of pre-competition training (one week before competitions). We considered that in this period sportsman's organism is the most sensitive to changes in breathing homeostasis [10]. Measurements were carried out in the process of evaluation of sportsmen's readiness for start, after hard physical loads, in period of activation of organism's re-creational functions.

Results of the researches

Analysis of mean indicators of heart rate's regulation (see table 1) witnesses about presence of high functional reserve of organism. Shifting of median and other statistic indicators TP and LF to upper levels of centile distribution (CD) witnesses about increased influence of sympathetic cardiac rate's regulation. Analysis of correlation of sympathetic and para-sympathetic parameters of heart rate's regulation points at domination of sympathetic regulation LF/HF, ms^2/ms^2 , with it level of correlations preserves in dynamic of measurements 2,9; 2,7; 2,7 conv.un. that corresponded to 4th level of centile distribution of limits of heart rate's parameters. With it, variations' coefficients (CV) were accordingly 74,0%; 43,0%; 65,4%. Characteristic features of correlation LF/HF, with high level of individual differences, points at need in structural analysis of heart rate's variability on the base of differentiated consideration of the mentioned characteristics.

Analysis of centile distribution of indicators of CP capacity's variability and general condition of regulating functioning of autonomous nervous system (TP) showed that indicator reduced (median's shifting from 4th to 2nd level of CD after training); with it in recreational period this indicator increased and returned to initial level. With general trend's of CD remaining unchanged analysis of LF and HF medians witnesses about increased influence of sympathetic regulation of heart rate. Indicators of sympathetic regulation are at higher level of centile distribution than indicators of para-sympathetic. It is naturally reflects in process of first two changes, when we speak about increased mobilization of organism's functions. At the same time we noted that in third measurement level of sympathetic regulation increases (4th level of CD median restores), with it level of para-sympathetic influences increases insignificantly (shifting from 2nd level to 3rd). With it coefficients of variation (CV – TP, LF, HF) were accordingly 40,1-68,2% – in the morning after sleep; 71,2-77,8% – after training; 54,1-64,1% – in the morning after sleep, next day. Indicators of variations witness about higher level of individual differences of heart rate parameters' correlations.

Table 1

Indicators of boxers' heart rate (n=12)

Statistic	Indicators of heart rate's regulation		
	TP, ms	LF, ms	HF, ms
First day: measurements in the morning after sleep			
X	111.4	99.5	34.6
Me	123.7	110.7	23.2
S	45.5	40.9	23.6
25%	81.5	77.2	21.1
75%	138.5	122	43.8
First day: measurements after training			
X	66.76	59.7	21.9
Me	47.8	41.8	14.6
S	47.9	45.11	16.9
25%	32.6	27.7	9.4
75%	111.9	102.7	33.7
Second day: measurements in the morning after sleep			
X	105.75	93.8	34.9
Me	117.2	112.6	29.6
S	54.0	50.6	22.4
25%	62.1	56.3	22.8
75%	135.7	127.1	44.5

Evaluation of breathing responsiveness was fulfilled on the base of analysis of breathing variability in standard conditions of rest. Sportsmen fulfilled 6 cycles – inhale-exhale.

Indicators of variability of spontaneous breathing are presented in table 2.

Table 2

Показатели реактивности системы дыхания

Statistic	TPSP, l/m	VLFSP, l/m	LFSP, l/m	HFSP, l/m	Tinsp, s	Texp, s	Vinsp, l	Vinsp/Texp
First day: measurements in the morning after sleep								
X	33.27	4.06	28.60	14.96	3.67	5.85	2.05	0.35
Me	28.00	3.90	25.20	12.00	4.12	5.57	1.98	0.34
S	16.86	1.81	13.83	10.02	0.99	0.70	0.73	0.11
25%	21.10	2.20	19.50	6.90	2.56	5.38	1.55	0.29
75%	43.80	5.60	32.70	26.50	4.57	6.53	2.32	0.41
First day: measurements after training								
X	35.52	4.18	28.45	17.23	3.37	5.76	1.80	0.32
Me	31.80	4.25	27.65	13.45	3.60	5.74	1.84	0.26
S	13.45	1.64	13.19	9.42	1.34	1.72	0.74	0.14
25%	26.10	2.75	21.20	9.10	2.31	5.15	1.34	0.22
75%	45.40	5.70	37.20	25.05	4.57	6.65	2.29	0.44
Second day: measurements in the morning after sleep								
X	29.93	3.63	23.33	15.26	3.91	5.16	1.78	0.37
Me	23.90	3.30	21.50	9.90	4.46	5.35	1.76	0.29
S	14.08	2.12	11.64	10.11	1.20	1.51	0.79	0.19
25%	20.80	2.20	16.20	7.60	3.31	4.96	1.24	0.23
75%	43.10	4.10	28.10	21.60	4.72	5.42	2.18	0.42

The character of centile distribution of inhale and exhale time, of inhale volume pointed at high level of response in general. Reducing of median's level with centile distribution was registered only by indicators of inhale-exhale correlation. It is evident that evaluation of respiratory system's responsiveness requires detail analysis of breathing structure (variability).

Evaluation of median with the help of CD pattern of spontaneous breathing witnesses about dominating of indicators of total capacity of variability of volume speed of air flow (TP), VLF and LF spectral components of breathing rhythm. It is also stressed by indicators, which correspond to upper (5th) level of CD. With it we registered trend, with which level of CD indicators reduces in the process of third measurement (at the next morning). It is natural owing to specific character of correlation of tiredness's processes – recreation in analyzed cycle of training.

At the same time analysis of HF median's distribution witnesses about preservation of reduced centile distribution's level during all period of measurements, including period of recreation after load.

Coefficients of variation (CV) of all indicators of breathing variability were accordingly: 31,5-70,0% – in the morning after sleep; 37,9–54,6% – after training; 29,3–58,4% – in the morning after sleep, the next day. Indicators of variation coefficients witness about high level of individual differences of correlation of heart rate regulation's parameters.

Discussion of results of the research

In general, analysis of results of heart rate variability and breathing indicators showed adequate response of sportsman accordingly to period of measurements (before, at the moment and 12 hours after load) and targets of training process in period of pre-start trainings.

The character of centile distribution of mean indicators, which reflected total capacity of HR variability and general condition of autonomous nervous system's regulating functioning as well as sympathetic and para-sympathetic regulations witnesses about functional readiness to tensed motion functioning of sportsmen (measurements were fulfilled one week before important start). This is proved by high level of mobilization readiness and level of load's enduring of boxers (absence of great functional shifts in organism) in the process of training, oriented on development of boxers' special endurance. At the same time analysis showed that level of indicators and character of correlation of

median's (HF) centile distribution in the process of three measurements witness about presence of reserves, connected with seeking of ways for additional activation of recreational processes in post-competition period.

At the same time the presented data witness about high level of individual differences of all indicators of heart rate regulation in homogeneous group of sportsmen. The problem is that with high level of indicators' individual differences there is practically no possibility to determine group trends in correlation as well as changes of correlations of sympathetic and para-sympathetic regulations of heart rate during all period of measurements. It significantly reduces possibilities of evaluation of organism's general (group) laws of response to training loads during measurement cycle before training, after training and in the morning, next day after training in homogeneous group of sportsmen.

It is evident that with absence of definite group laws evaluation of effectiveness of heart rate regulation, correlation of sympathetic and para-sympathetic processes in organism and connected with it evaluation of correlation of tiredness and recreational processes' activation can be analyzed, considering individual or typological features of sportsmen.

Characteristics of tiredness-recreation are a part of analysis of changes of sportsmen's functional condition under influence of physical loads. Naturally, there appears a question about evaluation of readiness or not readiness to realization of their functional potential degree in the process of training and competition functioning. In this connection HR indicators can be supplemented by characteristics of breathing responsiveness, which, in complex, reflect organism's ability to quickly, adequately and to full extent respond to physical loads that exactly is a target of sport training in conditions of actively alternating competition functioning, typical for modern boxing [10].

In this connection, one of the most informative criteria of evaluation of sportsmen's respiratory system's responsiveness and, as a result, of ability to mobilization, realization and recreation of functions are changes of responsive abilities of KPC, in particular breathing response. With it it is well known that structure of breathing response, pattern and variability of spontaneous breathing in rest, with its evaluation together with indicators of heart rate regulation have great degree of interconnection with responsive abilities of blood circulation system, its sensitivity to hypoxia and hypercapnia of load [4].

With stating of single effect of influence the existing criteria of evaluation of breathing pattern do not always give full picture about changes of functions, which characterize potentials of formation of required adaptation effect under influence of physical loads. It is well known that the highest realization effect of load takes place only, when single cycle of stimulation and recreational influences is realized. In general form this cycle is described in special literature [2]. This cycle switches on a system of means of workability's pre-start stimulation, workability's stimulation in the process of trainings and competition functioning, correction of tiredness after high physical loads. In compliance with it the necessary criteria of effectiveness of adaptation processes, i.e. complex evaluation, including evaluation of fitness or not-fitness of sportsmen for start, sportsman's condition after tensed training and competition functioning. Differences in sportsman's condition will permit not only to determine the level of load's influence on, "doze", but also its effect, connected with activation of recreational processes and formation, on this base, conditions for favorable adaptation to loads.

Analysis of changes of blood circulations system's responsiveness also showed significant range of individual differences in the process of all measurements. It, naturally, witnesses about need in analysis of individual data. Nevertheless, for foundation of conception we carried out analysis of changes of mean statistic indicators of median of breathing variability's indicators.

Analysis of changes of breathing responsiveness witnesses about high mobilization potentials of sportsmen. High level of responsiveness remained in the process of training. Simultaneously we stated that level of breathing response (by characteristics of sympathetic regulation) remained the same after load. Probably, it is connected with increased tension of function after training and reduced activation of recreational processes. It is also proved by high frequency parameters of breathing variability (HFSP), as well as by results of evaluation of heart rate variability, presented above.

Analysis of individual changes of all blood circulation system's indicators during training cycle permitted to mark out different types of responses to loads and, accordingly, different correlations "doze-effect" influence, which can appear under influence of single-type load for sportsmen of homogeneous group.

The first type is characterized by high level of mobilization fitness, sufficient depth of load's influence on organism and activation of recreational processes, by optimal correlation of "doze-effect" influence.

The second type also is characterized by high level of mobilization fitness, sufficient depth of load's influence on organism. With it we noted reduced level of recreational responses during first phase of recreational period. This type is characterized by increased tension of function and requires using of wider spectrum of recreational means.

The third type is characterized by reduced level of organism's mobilization fitness, by higher tiredness, achieved in the process of load and, as a result, by reduced level of recreational responses. This type is characterized by not readiness of organism's functional systems to tensed physical load.

The obtained results can be substantial supplement to existing criteria of effectiveness of sportsmen workability's functional provisioning. They can become the basis of foundation of new load's conditions and targeted stimulation of adaptation processes with preparation to start, in the process of trainings, in period of recreation and preparation to following stage of training and competition functioning [4].

Conclusions:

1. When testing of qualified boxers of homogeneous group with the help of instrument “SAKR”. We determined typological features of parameters of heart rate and breathing response before load, in the process and in period of after-effect of training’s load.

It was noted that combined evaluation of heart rate variability and spontaneous breathing gives picture about level of activation of starting mechanisms of functional provisioning of workability, level of functions’ mobilization in the process of training and activation of recreational responses in period of after-effect of great training loads. It is new mean of realization of control as function of training loads’ monitoring in the process of development of sportsmen’s special workability.

2. In the process of all periods of measurements we registered high level of individual differences of heart rate variability and spontaneous breathing. It points at differences in organism’s responses to homogeneous group sportsmen’s load in identical conditions of training and, as a result, proves demand in such analysis on the base of evaluation of correlation of individual indicators, taken in all three measurements’ periods.

3. On the base of evaluation of changes of heart rate variability and spontaneous breathing in the cycle of sport training we can receive data about quantitative and qualitative indicators of correlation of tiredness processes – recreation of organism in the process of development of boxers’ special development that is the basis for individualization of training process in system of current control of sport training in important and competition micro-cycles.

An urgent direction of research on this topic is analysis of changes of “doze-effect” influence in training meso-cycle.

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MODEL OF RECREATIONAL AND TRAINING SESSIONS BASED ON THE USE OF FUNDS AQUA PROFESSIONALLY APPLIED IN THE PREPARATION OF STUDENTS OF ECONOMICS

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Annotation. *Purpose:* study, develop and test a model of health-training exercises with the use of aqua. Material: in the experiment involved 69 students aged 17-18 years. *Results:* It was found that the developed model has a positive effect on physical performance of students promotes adaptive processes to the future professional activity and improve the learning process. Should consider the following: 1) the means and methods should be adequate aqua morphofunctional features and enhance the activity of the cardiovascular system, general endurance, power capabilities, flexibility, neurobehavioral performance, and 2) as a means of aqua aerobic exercise is advisable to use orientation and moderate intensity, and 3) use tools and techniques aqua should foster interest in a systematic and independent physical activities. *Conclusions:* the model promotes the development and improvement of the skills and abilities necessary to the future experts in economics.

Keywords: students, aqua fitness, model, health, training.

Introduction

Constant growth of contest on modern labor market put forward strong requirements to level of workability of future specialists of different kinds. High level of workability is conditioned by many components: sound health, good physical condition, high physical and psychic stability, ability to long-term and qualitative fulfillment of different works [2,10,12].

Modern system of high level specialists' training requires comprehensive improvement also in system of vocational training (Ye.I. Maliar, 2010; L.P. Pilipey, 2011). For achievement of the best result in training of highly qualified specialists, process of physical education in higher educational systems shall permanently develop. Condition of such productive innovative functioning of pedagogues is development and application of pedagogic innovations – "final result of implementation of innovations for perfection of object of control and receiving proper effect" [3,7,10].

Students' optimal physical development and fitness, sound health and high workability make the basis of creative attitude to mastering of professional skillfulness. Therefore, working out and implementation of innovative technologies and authors' programs in physical education of students, application of variable forms of trainings' conducting will facilitate purposeful preparation and adaptation to academic and professional functioning [1,8,9].

Such approach to this problem permits for us to regard fitness-technologies, videlicet aqua-fitness, as purposeful process of health related trainings and as one of ways of physical education and professional-applied preparation of students improvement, meaning students of economic specialties under credit-module system of education.

Purpose, tasks of the work, material and methods

The purpose of the research is to theoretically ground and experimentally test effectiveness of worked out by us model of health related trainings on the base of aqua-fitness means.

The tasks of the research: 1. On the base of analysis and generalization of scientific literature data to determine content of physical education content as well as content of professional-applied physical trainings of students of economic specialties on the base of innovative technologies.

2. Experimental testing of effectiveness of the worked out model of health related trainings with the help of aqua-fitness means.

The methods of the research: theoretical analysis and generalization of literature sources' data; pedagogic observation; testing pedagogic experiment; methods of mathematical statistics [5].

Organization of the research. In the research girl students of Ukrainian academy of bank business of National Bank of Ukraine (hereinafter called UABB NBU) and girl students of Sevastopol institute of bank business of UABB NBU (hereinafter called SIBB UABB NBU) The participants were divided into three groups: control group (CG, n=24) of UABB NBU were trained as per traditional program; experimental group 1 girl students (EG1, n=23) of SIBB UABB NBU and experimental group 2 (EG2, n=22) of UABB NBU were trained by worked out by us aqua-fitness program.

Results of the research

The existing programs on girl students' physical education are relatively of the same type. It results in reducing of students' motivation for practicing of physical exercises and sports, worsening of physical condition and workability [7,13]. That is why, with working out of model of health related trainings with aqua-fitness means we were guided by the following principles:

- Aqua-fitness methods shall be adequate to morphological-functional features and facilitate improvement of cardio vascular system's functioning, general endurance, flexibility, psycho-physiological qualities;
- As means of aqua-fitness it is purposeful to use exercises of aerobic orientation and moderate intensity;

- Application of means and methods of aqua-fitness shall facilitate formation of interest to systemic and independent physical trainings.

As the base of model of aqua-fitness trainings we took the following: health related training, complex trainings of applied orientation [4,6,11,14]. We used means of fitness, aqua-fitness, exercises of applied kinds of swimming, special exercises of applied orientation (see fig.1).

Depending on level of physical, mental, psycho-physical and functional abilities and set tasks, we simulated health related trainings, oriented on development and improvement of special physical qualities, manifestation of psychic abilities.

Academic process in health related – training model on aqua-fitness training was characterized by the following signs: minimum of means of training, accessibility and universality.

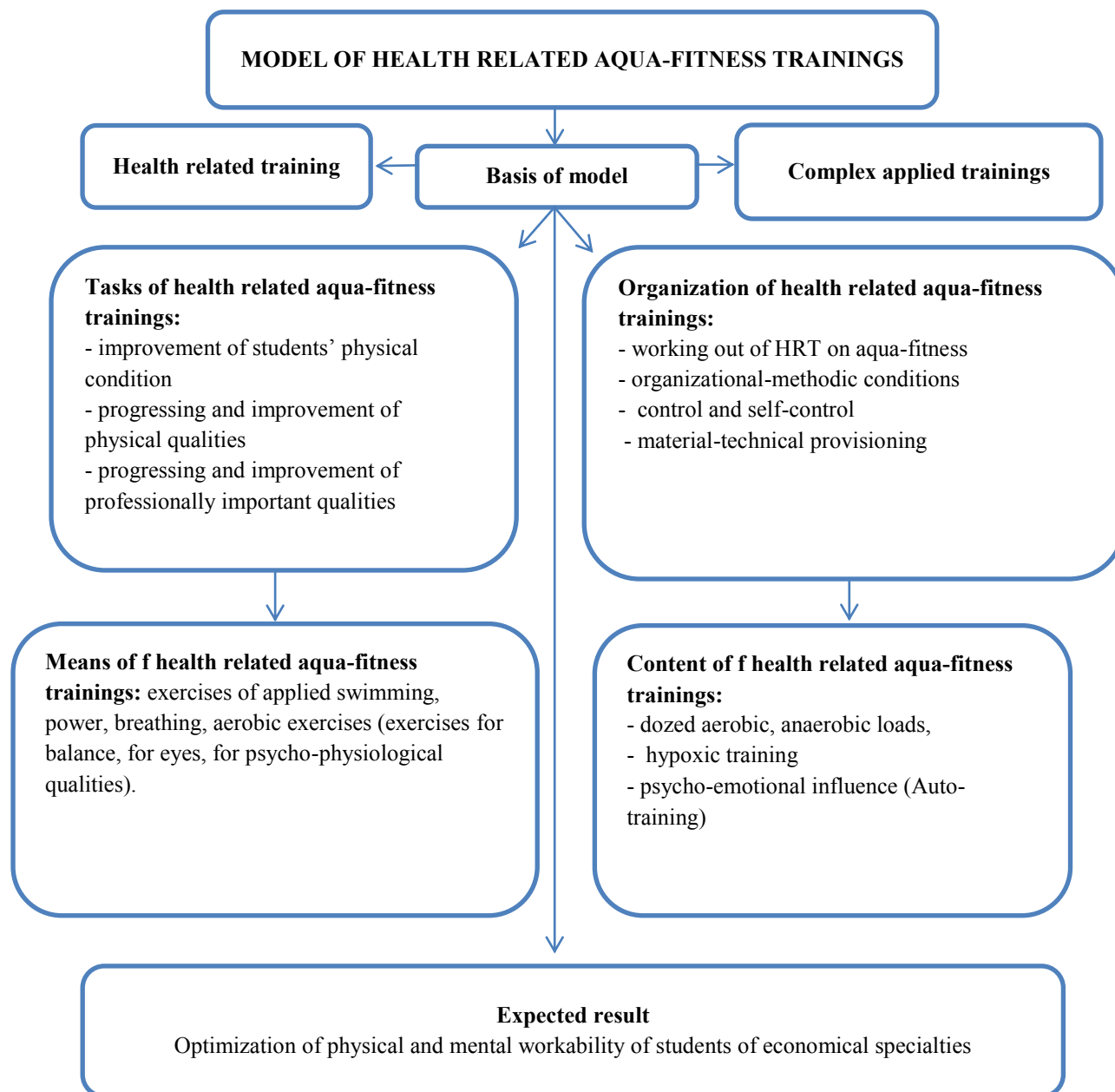


Fig.1. Structural-logic diagram of model of health related aqua-fitness trainings

When working out of model of health related aqua-fitness trainings we used complexes of special exercises for optimization of physical and mental workability of future economists (see fig.2). Planning of training process was carried out on the base of construction of training process in health related physical culture as well as on the base of health related trainings in water [4,6,8,15].

All these factors facilitated not only acceleration of training process but also solution of special training tasks.

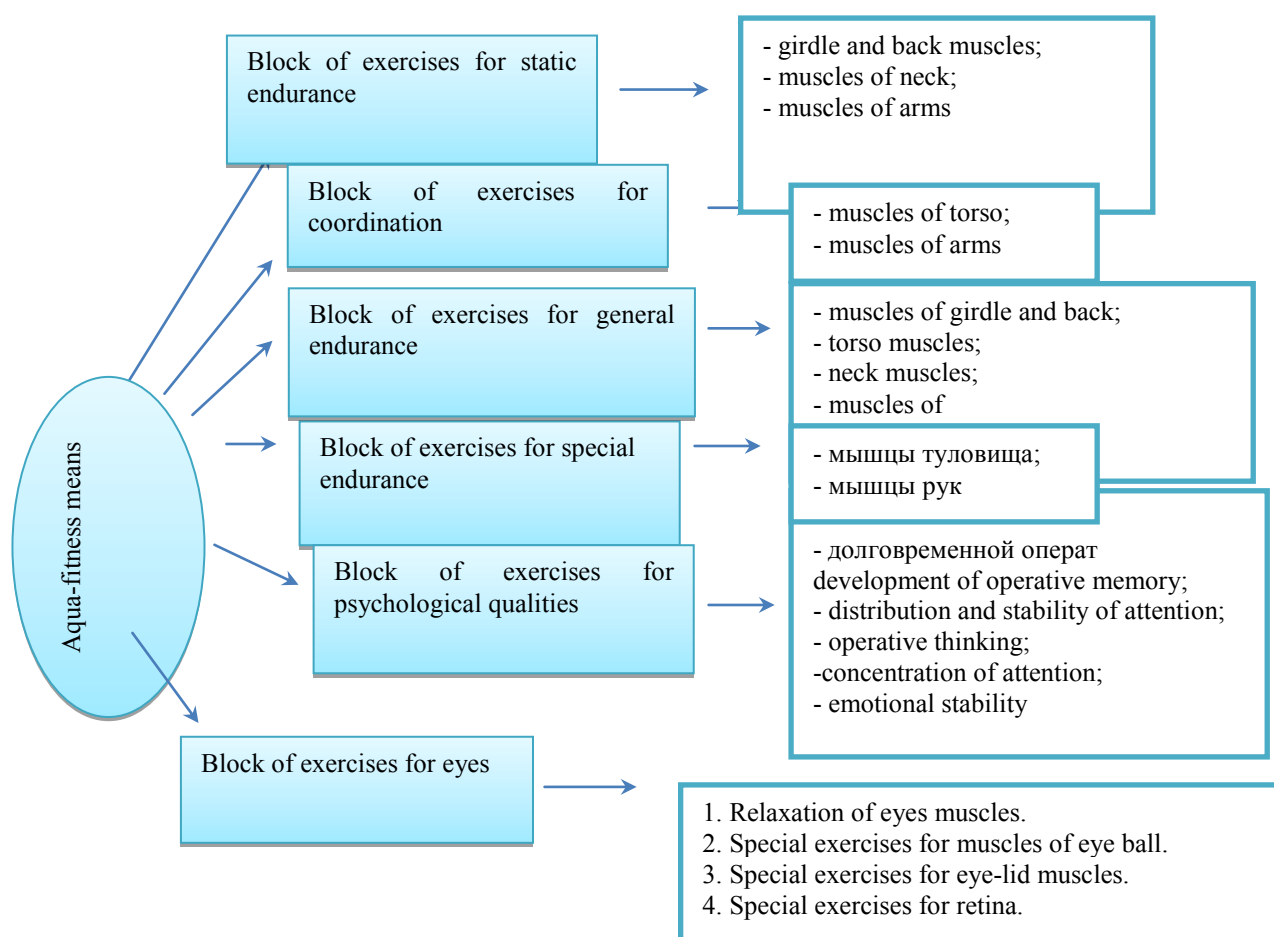


Fig.2 Means of aqua-fitness for optimization of physical and mental workability of students of economic specialties

The worked out by us model of health related aqua-fitness training showed its effectiveness in practice and it is witnessed by results of the researches. Experimental researches were carried out in two stages, during 2011-2012 and 2012-2013. At the beginning of the experiment there were no confident differences in data of EG1, EG2 and CG.

As it is seen from table 1, indicators of test PWC-170 in experimental group 1 and experimental group 2 increased. Results of control group also showed some positive increment but it was insignificant.

Table 1

Indicators of dynamic of girl students' physical workability

PWC-170	Groups	n	Data	Mx ± Smx	P
	EG1	23	Before	47.99 ± 1.12	<0.001
			After	54.85 ± 1.01	
	EG2	22	Before	48.75 ± 0.94	<0.001
			After	54.07 ± 1.01	
	CG	24	Before	46.63 ± 1.01	>0.01
			After	49.97 ± 0.86	

Conclusions:

Using of experimental model permitted to achieve significant increasing of experimental groups' girl students' physical workability. In experimental groups it was: EG1 – test PWC increased up to 11.4% (P <0.001), in EG2 – test PWC increased up to 11.3% (P <0.001), in CG – test PWC increased by 1.07% (P <0.01). Therefore offered by us experimental model, with aqua-fitness means as the base, positively influenced on physical workability of girl students-economists.

The conducted researches witness about purposefulness of this model's implementation in process of physical education of higher educational establishments' students – future economists, for improvement of their adaptation to future professional functioning.

Further researches imply seeking of new forms and methodic of physical education trainings of students-economists on the base of innovative technologies.

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TECHNICAL SPECIFICATIONS OF QUALIFIED SPORTSWOMEN WHO SPECIALIZE IN RACE WALKING FOR 10 KM.

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Annotation. *Purpose:* to identify the main biomechanical characteristics of qualified athletes. *Material:* The study involved nine athletes. Video footage used for hardware-software complex LUMAX (number of dimensions - 891). *Results:* systematized data on more than 15 references. Biomechanical characteristics of vehicles covered nine best athletes in the championship of Ukraine 2013. A comparative analysis of the results with the scientific and methodological literature. Notes the importance of calculating the utilization of anthropometric data (ratio of stride length and growth athlete). *Conclusions:* The main priority for enhancing athletic performance Ukrainian athletes is an increase of 2-3 cm length of stride, with increasing frequency index steps to 3.45 steps per second.

Keywords: athletes, athletic, walking, biomechanical characteristics, technique.

Introduction

The results level of winners of world sports forums in race walking among women is increasing. This requires improvement of permanent methods of preparing not only of world-class high-athletes at the stages of the maximum realization of individual possibilities and conservation of high sportsmanship but of female athletes who are at the prior stages of preparation of many years [6, 9].

If we consider the fact that changes in the volume and the ratio of means of training at the basic stages of long-term training can lead to speeding up of the training process, the emphasis on improving technical training can create ideal conditions for the achievement of good results in the future [8, 11].

This requires finding new ways of improvement, especially of the technical preparation of athletes specializing in race walking. And for this it is necessary to optimize the technology assessment techniques athletes specializing in race walking [4, 12].

Unlike other kinds of athletics, performance technique of race walking is severely restricted by competition rules, where exists a clear definition of it, based on which in race walking there should not be a phase of flight, or in other words there must always be a contact with a support, as well as a forwarded (supporting) leg should be fully extended in a knee joint from the first contact with the ground until the vertical passing [1, 3, 7].

In turn, the few studies [2, 5, 14, 15] devoted to techniques of race walking deal only with the main characteristics of the techniques of female athletes: traversing speed, length and frequency of steps over a distance.

Finding ways to increase the length and frequency of steps is the basis of technical improvement of athletes that require the identification of the characteristics causing the optimal ratio of these indices. This will determine the methodological approaches to the assessment of technology and create the conditions for the further development of technical skill of speedwalkers.

The studies have been performed according to the "Consolidated Plan of Scientific and Research Work in the field of physical culture and sports for 2011-2015" of the Ministry of Education and Science, Youth and Sports of Ukraine relating to theme 2.2 "Theoretical and methodological bases of preparation of sportsmen of high qualification in terms of professionalization (by example of athletics)", state registration 0111U001721.

Purpose, tasks of work, materials and methods.

The purpose of the study is to identify the main characteristics of biomechanical techniques of qualified athletes specializing in 10 km race walking.

Material and methods. To achieve the objectives the following methods have been used: analysis of scientific and methodological literature, pedagogical observations, anthropometry, video and computer analysis of motor actions of athletes and methods of mathematical statistics.

At the first stage of the research in the analysis of data of scientific and methodical literature (15 sources) there have been studied approaches to assessing the art athletes specializing in race walking.

At the second stage there have been made a biomechanical analysis of techniques a competitive exercise of nine athletes in the championship of Ukraine among the teams of sports schools in 10 km race walking (Ivano-Frankivsk, 2013).

Video filming with the observance of biomechanical requirements has permitted to make a quantitative and qualitative analysis of movements of speedwalkers. To do this there have been used the hardware -software complex «Lumax», basic specifications and features which are detailed in publications of developers [10].

The register of postures of athletes when performing competitions exercises have been made with camcorder "Sony DCR-SR 65" at 25 frames per second, followed by a breakdown on 50 shots.

All the metrological requirements have been taken into account that allowed the camera to place correctly and to minimize systematic and random errors. To digitize kinematics of biolinks of athletes there have been used 20 functioning model of the human body. In this application has a clear sequence of points.

At this stage, the results obtained were compared with the data of scientific and methodical literature.

At the third stage of the research there have been identified key issues and future directions for improvement of the technology assessment techniques athletes specializing in race walking.

Results of research.

Athletic performance in sports walking depends on the average speed of movement. In turn, the speed of movement depends on the length and frequency of steps. Thus, identification of these characteristics, as well as their relation is the foundation of technology implementation evaluation of race walking.

For achievement of high world level in race walking for 20 km, figures of women step length during competitive distance must be within 1,06-1,19 m at a frequency of steps 3,34-3,60 per second [13, 14, 15]. These indicators and their ratio vary in different athletes, which primarily depends on the growth, and the exact length of legs, as well as on the degree of technical and physical readiness.

As a result of our research the average length of steps in eight Ukrainian athletes (average result 50:14.15; $S = 1:03.0$) has amounted to 1.03 m ($S = 0,05$), which, of course, much less than the world's leading athletes. The frequency of steps on the average was 3.23 per second ($S = 0,05$) (table). In competition winner Inna Kashina (result 45:57.0) the frequency of steps was close to 3.45 pitch per second, with a length of steps about 1.05 m (drawing).

It should be noted that the length of the right-handers step with his left foot was 3-5 cm longer than with the right foot. Duration of the support phase also shows little difference in the various execution steps of the legs: the length in the right leg support with 0.27 second ($S = 0,01$), left - 0.29 second ($S = 0,02$), which confirms the great strength exhibited by the right foot.

However, in addition to finding the optimal ratio of the length and frequency of steps, it is important to determine the ratio of stride length and growth of the athlete (or rather to use an indicator of leg length, but it is practically not represented in scientific and methodological literature), which can be presented as the utilization factor of anthropometric data - K_a :

$K_a = L / H$, where L - stride length, H - height.

Based on current data of scientific and methodical literature [14, 15], which shows the individual characteristics related to growth and the length of the steps of leading athletes of the world, we can determine the model coefficient of use of anthropometric data - $K_a = 0,68$ ($S = 0,03$).

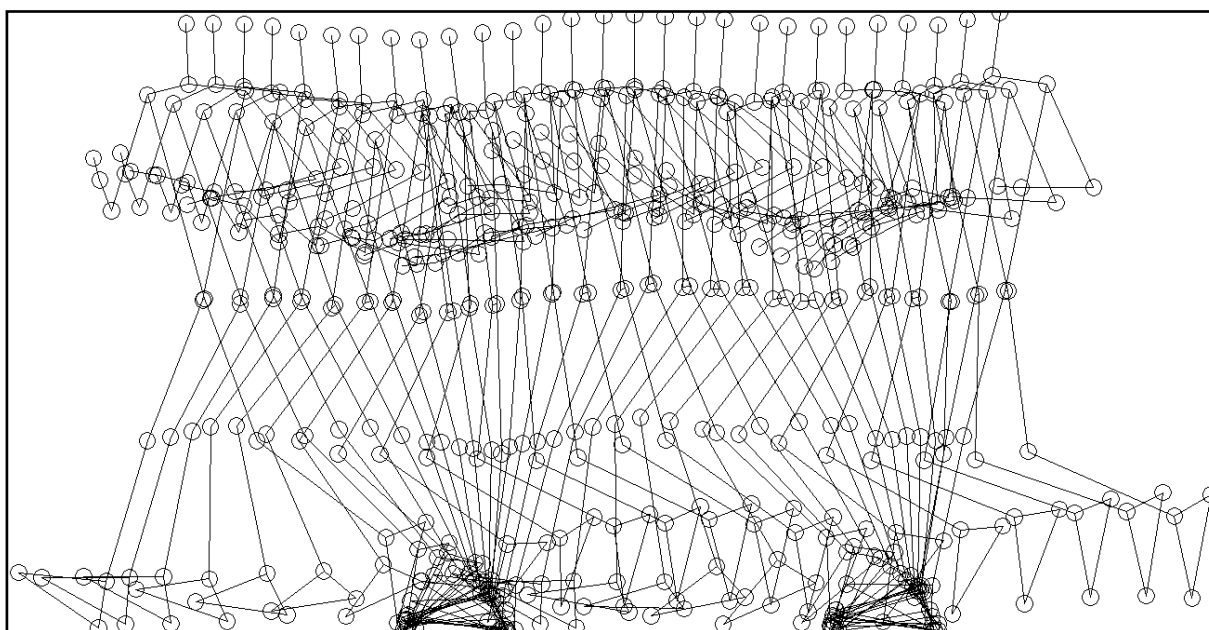
As a result of research, the average utilization rate of anthropometric data of qualified Ukrainian athletes is - 0,63 ($S = 0,15$), the winner in the competition - 0.65.

Table

Biomechanical characteristics of the techniques of skilled athletes who specialize in 10 km race walking (n=8)

Distance, km	Characteristic										
	result	height, sm	weight, kg	average speed, m/second	stride length, m	frequency of steps, step per second	single support phase duration, second	duration of depreciation in a single support phase, second	angle of foot setting on the ground, grade.	angle of repulsion, grade	angle in the knee joint, grade
1	50:14.15 (±1:03.0)	164,4 (±3,62)	50,0 (±4,60)	3,35 (±0,14)	1,04 (±0,05)	3,23 (±0,05)	0,28 (±0,01)	0,11 (±0,01)	66,43 (±0,21)	48,7 (±2,62)	175 (±2,24)
2				3,19 (±0,42)	0,99 (±0,06)	3,23 (±0,05)	0,28 (±0,01)	0,11 (±0,02)	65,31 (±1,89)	48,8 (±1,81)	174 (±2,67)
3				3,29 (±0,33)	1,02 (±0,05)	3,23 (±0,05)	0,28 (±0,01)	0,11 (±0,02)	66,43 (±0,34)	48,7 (±1,78)	175 (±1,35)
4				3,36 (±0,11)	1,04 (±0,05)	3,23 (±0,05)	0,28 (±0,01)	0,11 (±0,01)	66,44 (±0,19)	48,3 (±1,76)	175 (±1,55)
5				3,38 (±0,09)	1,05 (±0,05)	3,23 (±0,05)	0,28 (±0,01)	0,11 (±0,01)	66,38 (±0,26)	49,0 (±2,10)	174 (±2,58)
6				3,34 (±0,07)	1,04 (±0,05)	3,23 (±0,05)	0,28 (±0,01)	0,11 (±0,02)	66,49 (±0,33)	49,6 (±1,17)	175 (±2,02)

7				3,34 ($\pm 0,07$)	1,04 ($\pm 0,05$)	3,23 ($\pm 0,05$)	0,28 ($\pm 0,01$)	0,11 ($\pm 0,03$)	66,33 ($\pm 0,34$)	49,7 ($\pm 1,26$)	174 ($\pm 4,26$)
8				3,34 ($\pm 0,07$)	1,04 ($\pm 0,05$)	3,23 ($\pm 0,05$)	0,28 ($\pm 0,01$)	0,11 ($\pm 0,01$)	66,48 ($\pm 0,27$)	48,8 ($\pm 1,22$)	175 ($\pm 1,52$)
9				3,30 ($\pm 0,09$)	1,02 ($\pm 0,05$)	3,23 ($\pm 0,05$)	0,28 ($\pm 0,01$)	0,11 ($\pm 0,02$)	66,40 ($\pm 0,34$)	48,7 ($\pm 1,57$)	174 ($\pm 2,90$)
Average results over a distance				3,32 ($\pm 0,15$)	1,03 ($\pm 0,05$)	3,23 ($\pm 0,05$)	0,28 ($\pm 0,01$)	0,11 ($\pm 0,02$)	66,3 ($\pm 0,46$)	0,28 ($\pm 0,01$)	174,5 ($\pm 2,34$)



Drawing. Kinematogram of race walking of the champion of Ukraine on 10 km distance Inna Kashina

As can be seen from the table, the average speed to overcome all sections of distance ranges 3,19-3,35 m per second, indicating a small extent of some tactical training of athletes. Regarding basic competition rules, the biomechanical analysis showed in most cases observed athletes had a flight phase, but its duration was close to zero, in principle the judges are impossible to see it visually. The angle of the knee at the moment of setting foot on the ground averaged $174,5^\circ$ ($S = 2,34$), which is slightly less than that of the top competitors in the world - 180° ($S = 3$). It is seen that the angle of the knee decreased during the race, due, of course, fatigue.

Conclusions.

As the studies there have been examined the bases of evaluation of the techniques speedwalkers of high qualification. There have been analyzed the biomechanical characteristics of the leading athletes in Ukraine specializing in race walking for 10 km. It has been found that for the level of results 50:14.15 ($S = 1:03.0$), the average speed on the segments distance was 3.32 m per second ($S = 0,15$). The average pitch length was 1.03 m ($S = 0,05$), the frequency steps 3.23 steps per second ($S = 0,05$). The duration of the stance phase 0.28 ($S = 0,01$). The angle setting foot on the ground was $66,3^\circ$ ($S = 0,46$), the angle of repulsion - $48,9^\circ$ ($S = 1,7$).

An important direction of future research is to identify the most significant biomechanical indicators that best define the length and frequency of steps. This will improve the technology assessment of techniques of speedwalkers qualifications that, in turn, will create conditions to optimize the specific technical training.

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THE PREPARATION OF TOURISTS TO THE SKI SPORTS TOURS IN A LIMITED TIME IN ORDER TO PREVENT INJURIES AND ACCIDENTS

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Annotation. *Purpose:* compare indicators of testing tourist skiers at different stages of the preparatory period to ski sports hike of third grade. Determine the effectiveness of training programs created to the tourists. *Categorical:* ski sports to prevent injuries and accidents in a limited time. *Material:* The study involved 13 people aged from 21 to 65 (4 women and 9 men) with different experiences of hiking trails and various levels of total tourist preparedness. *Results:* The test results obtained before beginning the process of preparation are treated upon its completion, and immediately after passing categorical hike. In practice, the effectiveness of the proposed training programs of tourists to ski sports tours is proved. *Conclusions:* The created program can be recommended to tourist clubs, associations and organizations as the base in preparation for ski sports campaigns for the prevention of accidents and injuries.

Key words: sport tourism, tourists, ski trip, injuries, prevention, testing, training program.

Introduction

Despite the fact that sports tourism is becoming more and more popular every year, and thousands of new fans are pouring into the tourist movement, none of his species is not included in the Olympic program and is not a professional sport. Of course, the competition in certain types of sports tourism is held in the various championships and tourist centers, clubs, station, tourist clubs of universities, enterprises and organizations are preparing tourists athletes. But at the same time, mainly, sports tourism is still developing volunteer, thanks to the enthusiasm of tourists.

Sports hike is a component, the most active and dynamic part of the tourist activity, combining voluntary lovers of hiking, skiing, mountain, water, bike, car, motorcycle, speleological tours and fans of travelling in collapsible vessels of different classification [4].

With all its popularity sports tourism was, is and will be extreme and traumatic sport, therefore the problem of safety sports tours is one of the most important and at the same time complex problems of tourist movement [4, 14].

The great number of publications devote to prevention of accidents and injuries in various kinds of sports tourism and skiing, in particular. The basis of this work is many years' experience gained in the practice of sports tourism, both in the form of competitions in technique of sports tourism and sports and tourist hikes [3, 5, 9, 11, 14, 15].

Publications on this problem are only in the periodical literature and usually limited by moral and ethical side of individual cases. This level of information, and even more generalizations required some practical conclusions, of course, is insufficient and it does not respond social importance of the problem.

In recent years, the complexity of ski sports tours has increased significantly. Tourists skiers in mountainous taiga, tundra, Arctic regions overcome hundreds of kilometers, while away from civilization for several weeks. Sometimes these trips are made during the polar night, in the midst of an Arctic winter [2, 6, 10, 16].

To undergo such routes without a single accident and survive, we need extensive knowledge of the area in which the hike plans and conditions of passage, a sufficient level of total tourist, physical, technical, psychological, ski and ski, topographic and medical preparedness, skills and experience to ensure the ability of living in harsh winter conditions [5, 7, 9, 12, 17].

The work is done under the plan of Scientific Research at the Department of Physical Education and Sports of Kharkov National Economic University named after Semen Kuznets.

Purpose, tasks of the work, material and methods

Purpose of the work is to develop a training program for tourists skiers to ski sports tours of various complexity in the limited time given to prevent injuries and accidents.

Research objectives:

1. Compare test results of the experimental group at various stages of preparation.
2. Determine the effectiveness of developed training programs of tourists skiers to ski sports tours.
3. Check in practice (ski sports tours of third difficulty) the consistency and efficiency of the proposed training program for tourists skiers.

The practical significance - this program can be implemented in the tourist clubs of universities, enterprises and organizations, children's hiking clubs, tourist associations and organizations as a base for the preparation of tourists to the ski sports tours.

Materials and Methods. Researches were carried out from September to February, 2011-2012. Experimental group consisted of 13 people (9 men aged 21 - 65 and 4 women aged 24 - 28) having different experiences in water, hiking and mountain hikes, wishing to be trained according to the proposed program and take part in ski sports tours. For many years, all participants included in the group, engaged in various kinds of sports have many sports categories. Members of the group to the beginning of the experiment had a different experience of ski sports tours.

Due to the fact that tourists are not professional sportsmen, and usually goes in for several kinds of sports tourism, multi-year program of continuous training cannot be, because during one tourist season one can prepare to

water trips, in the spring-summer period, and in another they can prepare to a ski trip in the winter, or during one calendar year he can participate in several different hikes, having a special skills for them. Accordingly, the period of preparation for categorical ski sports hike was limited in time.

At the beginning of the experiment the whole group was tested by measuring the «*Quantity of health*». At one time, this concept identifies the backup of possibilities of an organism, introduced by N.M. Amoz. According to him, health is the maximum productivity of organs while maintaining the quality of the limits of their functions.

The «*Quantity of health*» is determined by counting the arithmetic average of the series (at least five) functional tests and test of the level of development of physical qualities, which indicators are compared with the norm (100% of predicted values for the age) (Table 1) [1].

Table 1

The rating of the «Quantity of health» and men's biological age (women's requirements are 10% below)

Indicators, tests	Age (years old)								
	20	30	35	40	45	50	55	60	65
The pulse rate after getting on the 4th floor (strokes/min.)	106	108	112	116	120	122	124	126	128
The pulse rate in 2 min. (strokes/min.)	94	96	98	100	104	106	108	108	110
Running 2400 m (min/sec)	11,5	12	12,5	13	13,5	14	14,5	15	–
Systolic blood pressure (mm Hg)	105	110	115	120	125	130	135	140	145
Diastolic blood pressure (mm Hg)	65	70	73	75	78	80	83	85	88
Stange's test (c)	50	45	42	40	37	35	33	30	25
Hench's test (c)	40	38	35	30	28	25	23	21	19
Bondarevskiy's test (c)	40	30	25	20	17	15	12	10	8
High jump (cm)	50	45	43	41	39	37	35	33	30
Pulling up on a crossbeam (times)	10	8	6	5	4	3	2	1	1
squatting (times)	110	100	95	90	85	80	70	60	50
Rising body from lying position in a sitting position (times)	40	35	30	28	25	23	20	15	12

In our study we used 12 functional tests for men and 11 for women. On completion the process of preparation for the hike, and after returning from the hike, the group was also tested to determine the «*Quantity of health*».

Results of the research.

Conducted researches of the physical preparedness to determine "the quantity of health" showed that this indicator has exceeded 100% in 10 out of 13 before preparing, and the rest ranged from 94% to 99%. The average indicator in the group was 104%.

During five months, the group held general physical (development of general endurance, power quality, speed, coordination, agility, etc.), topographic (map reading, compass work, orienteering, movement on the GPS receiver), general tourist (organization of halts, camp equipment, organization sleeping place, methods and types of making fires), health (the study of drugs, first aid after frostbites, stopping bleeding, bandaging and tires, artificial respiration, heart massage) special tourist (personal and team insurance, work with ropes, carabineers and the belay braking systems, work in systems, knotting, making scraper, rescue and transportation of the victim), ski and mountain ski (ski improvement of techniques of classical moves, overcoming obstacles, ways ascents, descents, turns, braking and stopping) the preparation [4, 8, 11, 13].

A month before the ski sports hike, the group has successfully held a training trip around Kharkov region.

Before the hike the group was tested again to determine the "quantity of health". The result showed that at the moment all members of the group had records more than 100%. Obtained data was between 104% - 141%. The average rate was 118%.

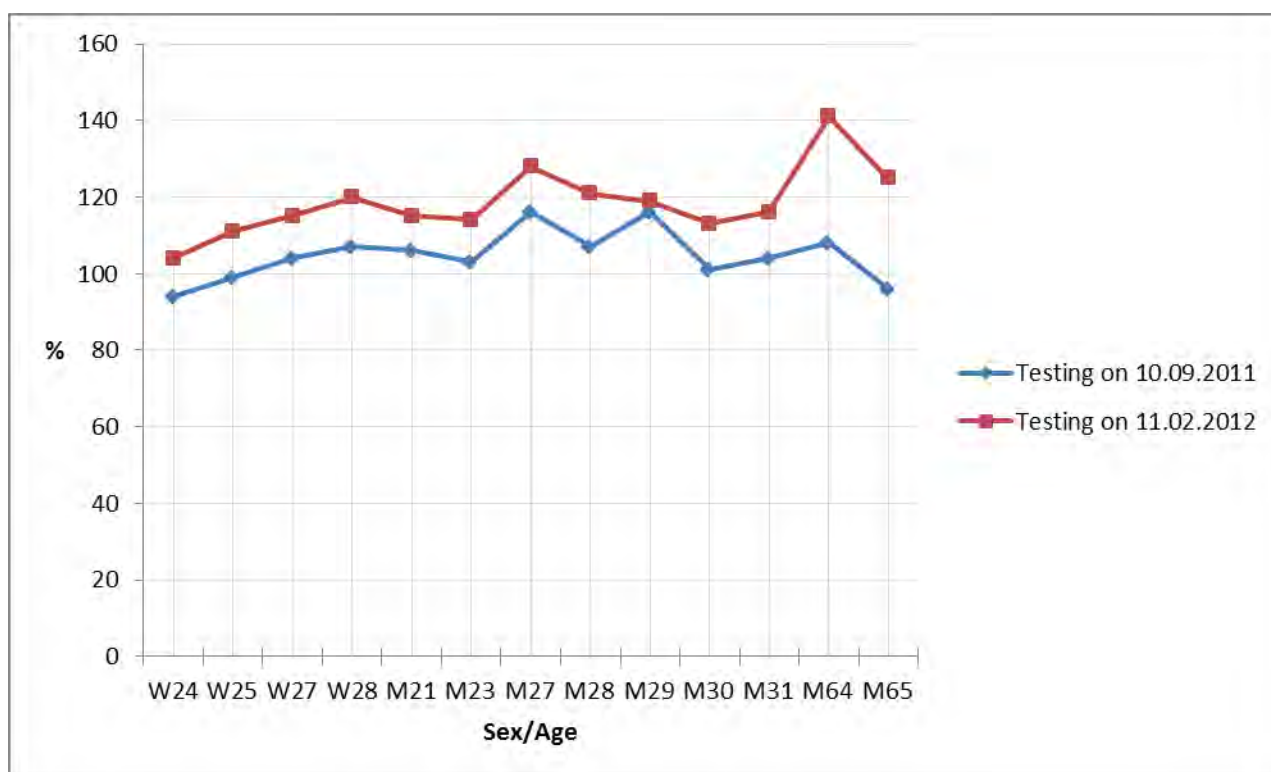
Table 2

Summary of tourists training program to ski sports tours of different degrees of difficulty in a limited time

Summary of tourists training program to ski sports tours of different degrees of difficulty in a limited time								
№	Content of training programs	Period of training						In total
		September	October	November	December	January	February	
		Amount of classes/ hours						
		12/3 6	13/3 9	13/3 9	13/3 9	8/ 168	6/ 18	65/ 339
I	Physical training (hours): 1) Development of general endurance: hiking, cross-hiking, cross-races, skiing movement. 2) Development of power qualities: exercise at the gym, with burdening, on a crossbeam, parallel bars, etc.	8	10	10	10	5	3	46
		5	7	7	7	3	2	31
II	Topographic training (hours): 1) Work with map and compass. 2) Moving on GPS navigator. 3) Participation in orienteering competitions in their age groups.	2	2	3	1	1	1	10
		2	2	1		1		6
		6	3	3				12
III	Tourist training (hours): 1) General: packing backpack, methods and types of making fires, making halts, installation of bivouac and organization of sleeping place, etc. 2) Special: work in safety systems with carabineers, ropes, etc. Self-insurance and team insurance.	3	3	3	3	3	2	17
IV	Ski training (hours): 1) Improving techniques of classic ski moves. 2) Overcoming of natural obstacles (ditches, moats, fallen trees, etc.) 3) Hill climbing in different ways.	3	6	6	3			20
					2	2		4
					2	2		4
					2	1		3
V	Mountainous ski training (hours): 1) Improvement of ski techniques (turns, braking, stop) 2) Overcoming the descents of varying steepness and difficulty.				2	1		3
					4	4	1	9
VI	Medical training (hours): 1) The study of drugs. 2) Medical first aid. 3) Organization and carrying out rescue operations. Transporting of the victim.	2	1		1			4
		2	2		2	1		7
			3	6			1	10
VII	Testing (hours)	3					6	9
VIII	Training ski tour (hours)					144		144

Ski racing hike of the 3rd c.d. (category of difficulty) on the territory of the Kola Peninsula on the route: St. Taybola – lake Votozero – lake Remesozero – the pass between Kunicha Shapka and Remesuyvench – lake Verhyavr – the river Kitsa – Turchepakench – the river Triberka – lake Verhniy Lunyavr – Zasheyka – the river Nyvka – Semen – st. Lovozero, which took place in the period from February, 20 to March 1, 2012, the group was successful. The route was overcome in a strictly scheduled. In the severe real conditions all tourist experience, expertise of skiers and other ski hikes was applied by the tourists skiers in practice, received practical pieces of advice, knowledge and skills gained

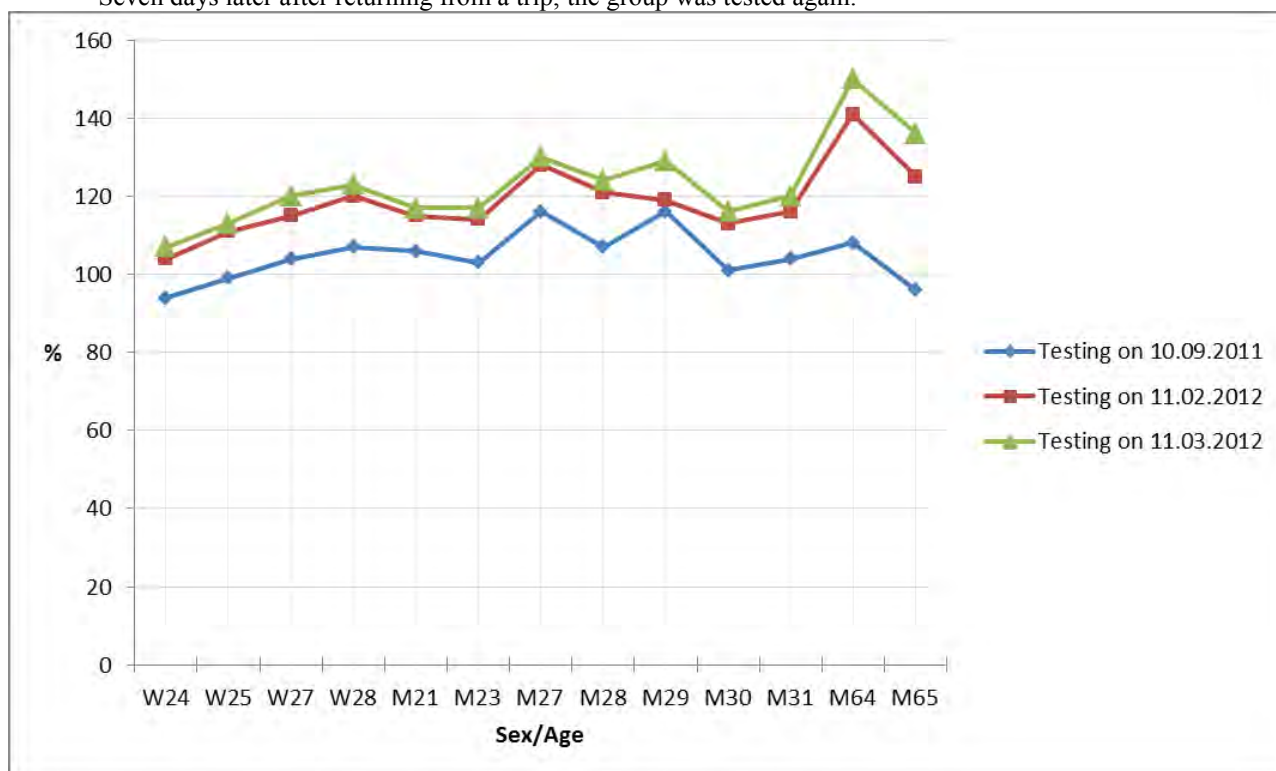
and improved in the process of training for a hike were used, observed discipline strictly and the leader of group's instructions were followed.



Pic.1 Participants of the experimental group's dynamics of change of the «Quantity of health»:

% - participants of the experimental group's indicators of "quantity of health", sex / age – sex / age of the participants, W24 - woman of 24, M30 – man of 30, etc., testing on 10.09.2011 – indicators of testing on 10.09.2011, testing on 11.02.2012 – indicators testing on 11.02.2012.

Seven days later after returning from a trip, the group was tested again.



Pic. 2. Participants of the experimental group's dynamics of growth of the «Quantity of health»:

% - participants of the experimental group's indicators of "quantity of health", sex / age – sex / age of the participants, W24 - woman of 24, M30 – man of 30, etc., testing on 10.09.2011 – indicators of testing on 10.09.2011, testing on 11.02.2012 – indicators testing on 11.02.2012, testing on 11.03.2012 – indicators testing on 11.03.2012.

At this time the results were in the range of 107% – 150%, and the average rate was 123%.

Table 3

Participants of the experimental group's changes of the «Quantity of health»

Sex/age	Date		
	10.09.2011	11.02.2012	11.03.2012
	Results, %		
W/24	94 %	104 %	107 %
W /25	99 %	111 %	113 %
W /27	104 %	115 %	120 %
W /28	107 %	120 %	123 %
M/21	106 %	115 %	117 %
M/23	103 %	114 %	117 %
M/27	116 %	128 %	130 %
M/27	107 %	121 %	124 %
M/29	116 %	119 %	129 %
M/30	101 %	113 %	116 %
M/31	104 %	116 %	120 %
M/64	108 %	141 %	150 %
M/65	96 %	125 %	136 %

W/24 – the indicators of woman of 24 at different stages of testing, etc.

M/30 – the indicators of man of 30 at different stages of testing, etc.

The obtained results follow that ski sports hike itself had also a positive effect on the growth of indicators of all members of the experimental group's the "quantity of health".

Conclusions

1. The participants of experimental group's comparative analysis of the results received at various stages of preparation were done.

2. It founds out that having classes on the created program promote the growth of physical qualities and increase the functionality of the body. The minimum growth rate was 11%, maximum is 42%. The average growth rate in the group is 19%.

3. The efficiency of the created and suggested training programs for tourists skiers to ski sports tours of different complexity was proved in practice (ski sports hike of the 3rd c.d.). The route was passed completely. The schedule of movement is sustained. All trip participants coped with their duties and were able to overcome the physical activities on the route. Dangerous and difficult sections were overcome according to the recommendations and basic tourist sports tours experience. Accidents and injuries were not during the hike.

Perspectives for further research: the program will be created for the training of tourists to mixed (complex) sports hikings.

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ORDER IN THE CHAOS IN SPORTS ORGANIZATIONS

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Annotation. *Purpose:* Nowadays, scientists consider the world as a combination of some systems that work in a self – organizing way and the result of such a way is unpredictable and accidental states. Compulsory Natural rules are affective in such circumstances. Also it is known that systems work in a circular form in which order ends in disorder and vice versa. The idea of world as something simple has already replaced by a complicated and contradictory world. The study aim is to survey chaordic organizations characters of sport organizations. *Materials and methods:* For this purpose we used a standard questionnaire with appropriate reliability and validity. The statistical population of the study are whole staff of sport and youth head-quarter of west Azarbaijan province that are 89 (sample number is equal to the population's). We used Kolmogrov- Smirnov test to study data normal distribution, and in respect of normal distribution of data to test hypothesis we used sample t test and also descriptive statistical methods like mean and standard deviation, through SPSS 18. Questionnaires were filled out by whole staff of sport and youth head-quarters of west Azarbaijan province. *Results:* Results of this study, which have got through a single-sample t-test, show that sport organizations have six characteristics of welcoming to innovation, coherence, uncertainty, non-linearity, unpredictability, and ugly structure. It's just the grade of the characteristic of recruiting competent staffs that is low in sport organizations; in fact they don't enjoy it. But, within assessing the main hypothesis of the research that was around the feature of chaos-order, it was resulted that sport organizations have characteristics of a chaos-order organization and they can be considered as a chaos-order organization. *Conclusions:* According to the results of this study and t-table we can deduce that sport organizations are chaordic organization.

Keywords: anarchy, edge, chaos, chaordic, organization, sport.

Introduction

Scientists of management have used some metaphors like recycle bin, creative, disharmonic, etc. for a complex organization. But today examining an organization through approaches such as chaos, complication, complicated and chaos-order organization provides us with a new attitude named “the theory of chaos-order organizations” that considers an organization as a system of holon structure. This word is derived from a chaos theory and complexity. The word chaotic refers to anything presents order and disorder, simultaneously. That is being between order and disorder. A chaotic organization not also is a system in which no action is done like the way before (two different ways of doing a same action), but also there is enough order to prevent complete disorder and anarchy (11). In other words a chaotic organization is a combination of numerous elements that create the general existence, and its behavior is unpredictable, and yet it has a pattern (order), too (3). Chaordic demonstrated the fact that all of behaviors and actions of various phenomena such as physical and physic phenomena in an organization, which seem to be erratic, have final order themselves. In fact it is an order inside disorder or a norm inside abnormally (1). Organizations work in competitive and turbulent environments have to match with chaotic organizations characteristics, to save their lives. It means to achieve chaotic characteristics, like being non-linear, must act consciously, if an organization wants to benefit from a chaordic organization.

Organizations working in competitive and turbulent environments should put themselves in an area of limited instability, in place of trying to maintain a stable situation. They should try to find a turbulent axis so that by using it as a lever, despite some financial and time expenses, bring company a big success. An organization should welcome disorder as a trusted partner (3). In other words, it should take the characteristics of a chaos-order organization to be able to maintain its presence in competition with rival organizations (5). Coherence, uncertainty, organizational awareness, diversity of statuses, and novelty are some Characteristics of a chaos-order organization of which managers should use in a reasonable and resourceful way.

Few researches have been done on the characteristics of a chaos-order organization among Iranian organizations. The only works have been done by Ghorbanizadeh and Arab in 2010 according to them; there are 7 signs of chaos-order in Iranian organizations naming: acceptance of innovation, coherence, uncertainty, non-linearity, unpredictability, ugly structure, and recruiting competent staff.

This article reviews the 7 features among sports organizations.

In chaordic systems any prolonged methods can't support the expected results, and managers should emphasize on a self-regulating process which is a result of organizational linearity and includes the unpredictable future and without any common initial purpose. The future will not be managed with planning and presupposed goals, but with developing and little by little behavior (13).

In chaordic systems one effect can have different causes, and thus the selection right is completely probable. Similarly a chaordic system may be much more than its total components (like the fact that a group behavior is bigger than a simple sum of complex individual behaviors) (13).

Organizations managers face numerous problems which have to make decision about them. Degree of importance for any problem the complexity and efficiency it has on organization, and every problem has its own degree of complexity and efficiency, naturally. According to Ralph Stacey there are 5 regions in which problems are created and we can recognize organizational problems and do proper actions in such regions, and the two main scales of them are "degree of creativity" and "level of agreement". Stacey has called the 5th region, the complexity region or disorder edge, this region is placed between the region of anarchy (4th region) and the regions related to traditional management approaches (1st, 2nd, 3rd regions). There is no level of importance for traditional management approaches in the region of complexity, rather this is the region for creativity, innovation and being separated from the past and create something new. In this zone, methods like Garbage-can decision-making, brain storming, usage of internal insight in fault detection, unscheduled decision-making identification, creating and choosing solutions, and creating innovative routines are into action (15).

Non-linear organizations refer to such complicated systems as self-organizing and adaptive organizations, within which the complicated nature of relation among system components, increase the involuntary order, and resulted features of it are far away from it's individual components, and there is no allegiance for causal linear rules (8). Within such systems there is a peaceful symbiosis between order and chaos, and system is always in move between order and disorder. Managers of these organizations may adopt such semi-solid strategies, that is not very fixed not so fluid.

Dee Hock argued organizations at disorder edge, as chaotic organizations. The word "chaotic" is a combination of two words: chaos and order, and it means being ordered and turbulent at the same time. This method is neither under dominance of order nor disorder. Chaotic organization is a dynamic, complicated, non-linear, creative, imbalanced, independent, and self-reliable system (3), which is placed at the edge of disorder and requires an innovative management style.

Complexity zone (the edge of disorder)

There is complexity all around the nature. Main principles of characteristics, which have to be noticed are: 1- goal and performance, 2-size and form 3- stricture (with all contents) and 4-dynamism type. These factors must be available in all of complexities. In most cases organs dynamism is high. Severity weakness transmission of this dynamism is related to environment. Structural complexity is one of most important characters. But we can not identify complexity directly and clearly (12). It can be said that complexity must not be eliminated and it has to be grown (5). In fact complexity zone is between distinction zone, which shoes chaos, connection zone which demonstrates order. We called this zone the edge of complexity or disorder, in which order and disorder, and separation and dependence are involved simultaneously (4). According to Langton in complicated systems located at the edge of complexity, there is a kind of peaceful symbiosis between order and chaos behaviors, and system is permanently moving between order and disorder, in other words there is another type behavior called disorder edge and if organization structures placed in this zone can benefit its advantages (6). At the edge of disorder, occurrence of real behavior has an interesting complexity and systems in these points have attraction power that increase probability of complicated behaviors. In other words the edge of disorder is where butterfly effect happens. Although we think most of living systems act in such structures (10). The challenge a head of managers at the edge of disorder or complexity zone is how to interpret subjects innovatively and choose a solution among countless solutions, which by transmissions to a new condition can coordinate the organization effectively with other organizations and environment. Kyle says about this subject: in severe instabilities like crisis or special opportunities in which related activities of compulsive services are high, recognition of this point is vital that stabilization again can achieved only by usage of progressive strategies that are naturally unstable. Finally we have to combine instability of such environment with managers performances and organizational dynamic strategies (10).

Sport Organization Management

In recent decades the managers of sport organizations have much difficulty to deal with in managing their organization. Commercialization of sport, important in society's knowledge levels, high levels of athletes and participants in sporting events expectations, universal changes, increase in sporting expenses, loss of adequate budget, and also encumbering governmental rules have made managers to be consistent with new condition s and try harder to reach their organization's goals. the aim of this study is to investigate to investigate to chaordic of sport organizations according to present circumstances in sport organizations and the way their managers deal with these circumstances.

Chaordic Organization Characters

As already mentioned, there are seven characteristics of "acceptance of innovation, coherence, uncertainty, non-linearity, unpredictability, ugly structure, and recruiting competent staff" known in Iranian organizations as chaos-order characteristics. Some other researchers like Eijentin (2004) enumerate organizational awareness, coherence, uncertainty, embracing change, and unexpectedness as characteristics of a chaos-order organization (11). Furthermore, discontinuous growth, organizational awareness, coherence, flexibility, continuous evolution and self-organizing (16) are some other characteristics listed for such organizations. The following text outlines the seven chaordic characteristics mentioned as those of Iranian organizations.

Acceptance of innovation: this element indicates despite the fact that the route of professional promotion in this kind of organization is unclear and unpredictable; the possibility of remaining and making progressions on behalf of innovative staffs is more probable.

Coherence: In chaotic organizations an organization is a part of a larger system yet a whole by itself. No component can exist without dependence to the whole, while no whole can exist without its components. Any component is a whole by itself, while belonging to a larger whole (11). In other words, staff and

Components of an organization, through using suitable methods and tools, are related and make a whole, while they are a whole separately.

Uncertainty: according to this feature, any event is both cause and effect simultaneously. That's why the future is not predictable and the role of the past is like a memory. So, the restructuring of an organization should increase flexibility in all aspects. In such circumstances, the concentration is on "willingness to change" instead of "planning to make wonder" (11). In chaos-order organizations, due to unpredictability of future, no long-term plan could cover expected results (9). Hence, the organization should concentrate on willingness to change in place of planning to change (16).

Non-linearity: being non-linear means that an effect can have diverse causes, so the right to choose is probable. A non-linear system can be much more than its components. Its behaviors are neither stable nor unstable (stability along with instability). They are constantly getting new and creative (9). This element demonstrates the aspect of clutter and transgression of past methods and shows that there is no much coordination between staff's duty and freedom in chaos-order organizations; there is freedom in doing duties, salaries are not compatible to function, the unity of management and command- that is a feature of traditional organizations- is less here, and the managers should spend lots of time to study technical texts in order to control the different situations (5).

Unpredictability: unpredictability refers to those kind of unusual problems that may occur to an organization. Drastic changes, erratic behaviors, unpredictable alterations, critical movements, all ultimately lead in a pattern that the manager should find it by his/her art (2). Because of unpredictability and unusualness in this kind of organizations, managers should spend lots of time to coordinate between people and solve problems.

Ugly structure: ugly structure denied the traditional organizations in which every staff is charged with responding to just one manager. In this kind of coworking one staff may be charged with responding to more than one manager. The managers should spend a lot of their time in meeting to coordinate between different units (5).

Recruiting competent staff: Due to characteristics like coherence, environmental turbulences, non-linearity, and welcoming to innovation, the organizational structure are continuously subject to change; some jobs are omitted and other jobs replace them. Recruitment of new employees are based on capabilities and merits needed by the organization. The applicants are equally considered in order to the competent ones get chosen (5).

Methodology

This paper is the result of an expanding research and is done with a descriptive method. This is a field study and for collecting data we used a standard questionnaire, with contextual validity method for evaluating the validity, and to calculate the reliability we enlisted the help of Cronbach's α , which its value was acceptable ($\alpha = 0.76$).

The statistical population of this study were whole staff of W. Azarbaijan province sport and youth headquarter that were 89 (the sample number is equal to the population's, $N = n = 89$). We used Kolmogorov- Smirnov test to study data normal distribution, and in respect of normal distribution of data to test hypothesis we used sample t test and also descriptive statistical methods like mean and standard deviation, through SPSS 18. questionnaires were filled out by whole staff of sport and youth head-quarters of west Azarbaijan province.

Findings

The Kolmogorov- Smirnov test has been used to examine the usualness of the data. the distribution was normal, so we described the data first and then analyzed them and proved the hypothesis.

Table1

The results of Kolmogorov- Smirnov test

	Chaordic organizatio n characters	Recruitin g competen t staff	Ugly structur e	Unpredictabilit y	Non- linearit y	Uncertaint y	Coherenc e	innovatio n
Z Kolmogrov - Smirnov	1/01	1/87	0/931	0/725	1/06	1/13	0/874	0/846
Sig	0/288	0/107	0/364	0/532	0/209	0/156	0/430	0/471

As it can be seen in Table 4-4, the level of significance is more than 0/05 in variables studied, and then the assumption of normality of the data is rejected. Hence the data's distribution is normal. In order to assess hypothesis separately, the degree of fulfillment of each of the features of the chaos-order organization has assessed by means of the single sample of t-test.

Table2

The descriptive statistics parameters of hypotheses

variable index	frequency	mean	Standard deviation	Deviation from mean error
innovation	89	3/11	1/23	0/13
Coherence	89	3/42	0/56	0/06
Uncertainty	89	3/08	1/33	0/14
Non-linearity	89	3/06	1/01	0/11
Unpredictability	89	3/16	0/99	0/11
Ugly structure	89	3/54	0/80	0/09
Recruiting competent staff	89	2/95	0/89	0/09

Table3

The results of one-sample t test of hypotheses in sport organizations

Population mean	Level of confidence95%		Mean difference	significance	Degree of freedom	t	
3	Up limit	Down limit					
	0/38	-0/14					
3	0/53	0/30	0/42	0/000	88	7/01	Innovation
3	0/36	-0/20	0/08	0/579	88	0/56	Coherence
3	0/28	-0/16	0/06	0/56	88	0/59	Uncertainty
3	0/37	-0/05	0/16	0/14	88	1/49	Non-linearity
3	0/71	0/38	0/54	0/000	88	6/40	Unpredictability
3	0/14	0/24	-0/05	0/59	88	-0/54	Ugly structure
							Recruiting competent staff

On account of the Table's "t" s and present themes the result is:

1. In sport organizations the characteristic of innovation is pleasing, but it's not so much different from the society's average on it. Hence, the first hypothesis is confirmed.
2. The characteristic of coherence in sport organizations is pleasing and it differs from the society's average on it, hence this hypothesis is confirmed too.
3. The characteristic of uncertainty in sport organizations is pleasing, but statistically there is no sharp difference between them and the society's. The third hypothesis is confirmed too.
4. The degree of fulfillment of the characteristic of non-linearity in sport Organizations are pleasing, but it is not so much different from the society's statistical average. The forth hypothesis is confirmed too.
5. The degree of fulfillment for the characteristic of unpredictability is western organizations is pleasing, but it doesn't much differ from the society's statistical average. Hence, the fifth hypothesis is confirmed.
6. The degree of fulfillment for the characteristic of "ugly structure" in sport organizations is pleasing, and it differs much from the society's statistical average.
7. Recruitment of the competent staff in sport organizations is less than the society's average, but there is no sharp difference. Hence the seventh hypothesis is rejected.

The Test of main hypothesis: Sports organizations have the character of chaordic organizations.

Table4.

The descriptive statistics parameters of main hypothesis

variable index	frequency	mean	Standard deviation	Deviation from mean error
Characters of chaordic organization	89	3/19	0/47	0/05

Table5

The results of one-sample t test of main hypothesis in sport organizations

Population mean	Level of confidence95%		Mean difference	significance	Degree of freedom	t
	Up limit	Down limit				

3	0/29	0/09	0/19	0/000	88	83/3
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As for the “t” in the Table4 and the present themes it can be concluded that the degree of fulfillment of a chaos-order organization’s characteristics is pleasing in sport organizations, it is higher than the society’s average on it, and it differs much from the society’s statistical average.

Discussion and conclusion

According to characteristics noted on a chaos-order organization, events are so complex and dynamic that they look chaotic. But the truth is, a chaos-order organization has a sort of infrastructural and concealed order, and explanation of such an order is difficult, though not impossible. Because there are lots of ingredients and parameters important in formation of unpredictable and

Dynamic behavior of phenomenon and production of their future behavioral pattern (7).

For as much as structures are different in in chaos-order organizations, problems happening are not compatible to previous experiences, there are lots of behavioral changes needed, and the speed of changes is very high. Metaphorically the metaphor of “the organization as a brain” is suitable for this sort of organizations (10).

This article tries to assess an approximately new concept in sport organization’s management naming chaos-order organizations. Sport organization is always in turbulent and competitive environments .their managers should distinguish their organizational characteristics right and decide sagaciously so that maintain their competitive prominence. The season of managements dependent to budget has now ended. Those that were petitioning for money proportionate to the project they wanted to make progress in. Nowadays there are few managers in the area of competitions and lacks and infrequencies who know the secret of getting from little too much (2).

Managers should know that a successful organization is the one that enjoys a non-linear dynamic feedback system that acts on the area of turbulent boundaries and creatively correlates the organization’s functions, inner sub-systems, and outer activities through self-organization – that is a quality of chaordic organizations.

According to above subjects managers must provide organization preparation to self-organizing, creativity, frequent and broad learning of process-oriented team work, innovative interaction with environment, and recognition of sensitive points, through characterizing more aspects of non-linear systems culture in organization(7).

Various characteristics have been distinguished during a research on the language of chordic organizations .according to Ijintin (2004) awareness, coherence, uncertainty, versatility of states, and innovation are some characteristics of a chaos-order organization (10). There is another category to which we come across while considering the language. It is the category of Rid &Denty (2006) of characteristics of a chaos-order organization in which characteristics such as discontinuous growth, organizational awareness, corelatedness, flexibility, continuous evolution, and self-organizing(16) are mentioned.

Results of this study, which have got through a single-sample t-test, show that sport organizations have six characteristics of welcoming to innovation, coherence, uncertainty, non-linearity, unpredictability, and ugly structure. It’s just the grade of the characteristic of recruiting competent staffs that is low in sport organizations; in fact they don’t enjoy it. But, within assessing the main hypothesis of the research that was around the feature of chaos-order, it was resulted that sport organizations have characteristics of a chaos-order organization and they can be considered as a chaos-order organization. It should be noted that the results of this study are strongly compatible with Ijentin (2004), Rid &Denty (2006) and Ghorbanizadeh (2010).

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SCHOOL AND OUT-OF-SCHOOL PHYSICAL ACTIVITY OF CHILDREN IN RURAL AREAS

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Annotation. *Purpose:* The aim of the study was to assess the level of school and out-of-school physical activity of children living in rural area at the early stage of their education. *Material:* The research was conducted in 2009 at primary school in Świętajno (a village). The study group consisted of 42 girls and 44 boys from the 1st, 2nd and 3rd grade of primary school, aged 7-10. The children were chosen by means of a purposeful selection and surveyed by a questionnaire consisting of five open-ended and five closed-ended questions. *Results:* The research showed that the children living in the rural area at the early stage of their education eagerly participated in the classes of physical education held at school. The most popular physical activities among the children included: games and plays with the ball and other equipment, running, gymnastics (among girls) and matches and competitions (among boys). The outdoor physical activities in which the children were involved outside of school were spontaneous and unorganized including mainly cycling, roller-skating, skating or skiing. *Conclusions:* A marginal percentage of children participated in out-of-school sports trainings or other physical education-oriented classes (e.g. swimming lessons). A relatively high percentage of children devoted a great deal of their free time to watching television, DVDs or playing on the computer.

Key words: children, rural, areas, education, age, physical, activity.

Introduction

Shaping pro-health attitudes among early school children poses a formidable challenge to all governments worldwide. Inappropriate lifestyle of children tends to be correlated with heightened risk of falling ill with long-lasting diseases of civilization (Starosta, 2010) such as: hypertension, heart diseases, diabetes, osteoporosis, specific types of cancer or even mental disorders (Rütten & Abu-Omar, 2004; Kafatos et al., 1999), which might be accompanied by overweight and obesity (Chiorello et al., 2009). The latter constitutes a particular health problem as it is commonly a cause of other illnesses. For example as a result of higher BMI values blood pressure increases, which, in turn, results in higher risk of inner damages such as: hypertrophy (Sorof et al., 2004) or stiffening of the carotid intimal medial (Li et al., 2003). Moreover, overweight and obesity when experienced in childhood usually result in higher risk of hypertension in adult life (Bao et al., 1995).

One of the reasons for overweight and obesity among children is their low and insufficient level of physical activity (PA) combined with sedentary lifestyle (Rohrer et al., 2008). In the group of non-pathological health conditions, PA and motor fitness (MF) are commonly emphasized as key indicators measuring human physical health. Governmental and international organizations worldwide as well as promoters of universal pro-health education have implemented numerous programs encouraging children and adolescents to lead an active lifestyle, however their effectiveness seem to be unsatisfactory as they fail to produce tangible outcomes (Rohrer et al., 2008; Dwyer et al., 2003). According to Surgeon General every child is recommended to be engaged in a 60-minute workout every day of the week (Lee et al., 2007).

Cultivating pro-health habits and active lifestyles among young children should be the subject of major concern to parents and educators and, consequently, to the whole society and its government. Limited information on health issues and possibilities of diminishing some health risks poses a serious problem, which particularly relates to children growing up in rural areas. The arguments presented above seem to justify the research on determining the attitudes of children living in rural areas in the aspect of physical activities performed during their school and leisure time. For this purpose the following research question was formulated:

What is the level of PA of early school children during their school and leisure time?

Material and methods

Participants and procedures

The research on PA was conducted in 2009 in primary school in Świętajno (warmińsko-mazurskie voivodeship, rural area) which comprised a group of 42 girls (48,8%) and 44 boys (51,2%) aged 7-10 all attending 1st, 2nd or 3rd grades of primary school. The children were selected by means of a purposeful selection i.e. all the children attending early school classes in this school were surveyed by a questionnaire consisting of five open-ended and five closed-ended questions.

Statistics

Descriptive statistics were used in order to calculate the numerical and percentage data for individual questions. Statistical analysis and the presentation of the results were performed using computer software Winstat and Statistica PL.

Results

The results of the research on school and out-of-school physical activity of early school children were presented in tables 1-10.

Table1.

The attendance of early school children at P.E. classes in relation to their sex

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Full attendance	11	26,2	13	29,5	24	27,9
Occasional absence	29	69,0	31	70,5	60	69,8
Notorious absence	2	4,8	0	0	2	2,3
Total	42	100,0	44	100,0	86	100,0

As can be seen from table 1, out of all the children almost one third (27,9%) attended every P.E. class, over two-thirds (69,9%) were occasionally absent at P.E. classes, and a marginal percentage (2,3%) were notoriously absent. In the case of both girls and boys, the highest percentage of respondents were marked by sporadic absence during P.E. classes (69,0%, and 70,5% respectively). None of the boys were notoriously absent at P.E. classes (Tab. 1).

Table 2.

Cause of the children's absence at P.E. classes

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Being ill	30	96,8	25	80,6	55	88,7
The lack of sports outfit	1	3,2	4	12,9	5	8,1
Other	0	0	2	6,5	2	3,2
Total	31	100,0	31	100,0	62	100,0

Table 2 shows that being ill was the common cause of absence at P.E. classes (88,7%), whereas absence due to the lack of sports outfit (boys and girls) or other reasons (boys) related to a marginal number of respondents (8,1% , and 3,2% respectively).

Table 3.

The level of regret about being absent at P.E. classes

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
High	22	71,0	18	58,1	40	64,5
Medium	8	25,8	12	38,7	20	32,3
Low	1	3,2	1	3,2	2	3,2
Total	31	100,0	31	100,0	62	100,0

As it is shown in table 3, the vast majority of girls (71,0%) and boys (58,1%) expressed a high level of regret about not being able to attend P.E. classes. Over one-fourth of the girls (25,8%) and 38,7% of the boys regretted the classes moderately, and the smallest percentage of the girls and boys (3,2%) regretted the classes very little (Tab. 3).

Table 4.

The level of satisfaction/dissatisfaction with attending P.E. classes

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Satisfaction	40	95,2	42	95,4	82	95,4
Dissatisfaction	1	2,4	1	2,3	2	2,3
Obligation	1	2,4	1	2,3	2	2,3
Total	42	100,0	44	100,0	86	100,0

As can be seen from table 4 the vast majority of girls (95,2%) and boys (95,4%) were satisfied with attending P.E. classes. Only one girl and one boy participated in P.E. classes unwillingly and because of obligation (Tab. 4).

Table 5.

Favorite forms of activities during P.E. classes in the opinion of children

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Games and plays with ball	28	66,7	38	86,4	66	76,4
Games and plays with other equipment	22	52,4	10	22,7	32	37,2
Races	18	42,9	26	59,1	44	51,2
Gymnastics	14	33,3	4	9,1	18	20,9
Matches and competitions	8	19,0	14	31,8	22	25,6

Abbreviations: three answers at the maximum

The most popular forms of PA among the children included: games and plays with the ball (76,4%), races (51,2%), games and plays with other equipment (37,2%), matches and competitive games (25,5%), and gymnastics (20,9%). The girls preferred games and plays with other equipment to races (52,4%, and 42,9% respectively), whereas the boys favored the races over the plays and games with other equipment (32,7%, and 51,2% respectively). Over three times more girls (33,3%) than boys (9,1%) enjoyed doing gymnastics. A higher percentage of boys (31,8%) in comparison to girls (19,0%) were keen to participate in matches and competitions (Tab. 5).

Table 6.

The status of P.E. classes at school according to the children

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Compulsory to all	40	95,2	42	95,4	82	95,4
Voluntary	2	4,8	2	4,6	4	4,6
Total	42	100,0	44	100,0	86	100,0

According to a decided majority of pupils, P.E. classes should be compulsory to everyone (95,4%). A marginal percentage of girls (4,8%) and boys (4,6%) stated that such classes should be voluntary (Tab. 6).

Table 7.

The amount of time the children spend outdoors in their leisure time

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Everyday	34	80,9	36	81,8	70	81,4
2 – 3 times a week	5	11,9	4	9,1	9	10,5
Less frequently	3	7,2	4	9,1	7	8,1
Total	42	100,0	44	100,0	86	100,0

More than 80% of the children spend their free time outdoors everyday (girls – 80,9%, and boys – 81,8%). Slightly more than 10% of the children stay outdoors two up to three times a week (girls – 11,9%, and boys – 9,1%), and about 8% - less frequently (girls – 7,2%, and boys – 9,1%) (Tab. 7).

Table 8.

Forms of outdoor physical activities taken by the children in their leisure time

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
In summer: cycling, roller skating. In winter: ice skating and skiing	37	88,1	40	90,9	77	89,5
Strolls	13	30,9	0	0	13	15,1
Playing a ball	29	69,0	38	86,4	67	77,9
Hopscotch, badminton	15	35,7	0	0	15	17,4
Playing with jump rope	14	33,3	0	0	14	16,3
Races	18	42,9	26	59,1	44	51,2
Swimming	4	9,5	6	13,4	10	11,6

Abbreviations: three answers at the maximum

As can be seen from table 8 the most popular outdoor activities in summer included: cycling and roller skating, whereas in winter – ice skating and skiing (girls – 88,1%, and boys – 90,9%). Playing a ball and badminton (69,0%), races (42,9%), hopscotch (35,7%), playing with a jump rope (33,3%) as well as going for strolls were the activities in which the girls took keen interest, whereas playing with a ball and badminton (77,9%) as well as races (51,2%) were the activities which the boys found highly enjoyable. Outdoor activities such as: hopscotch, playing with a jump rope and going for strolls were generally less favored by the boys (17,4%, 16,3%, and 15,1% respectively). The smallest number of children attended swimming classes during their leisure time (girls – 9,5%, and boys – 13,4%) (Tab. 8).

Table 9.

The children's companions in their free time

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Classmates	12	28,6	11	25,0	23	26,7
Friends from the playground	17	40,5	19	43,2	36	41,9
Siblings	13	30,9	14	31,8	27	31,4
Total	42	100,0	44	100,0	86	100,0

As can be seen from table 9, friends from the playground constituted the biggest group of the children's companions in their leisure time (girls – 40,5%, and boys – 43,2%). Slightly less time was shared with their siblings (girls – 30,9%, boys – 31,8%) and the smallest amount of time was spent with the children's classmates (girls – 28,6%, boys – 25,0%).

Table 10.

The children's favorite forms of activities in their free time

Responses	Girls		Boys		Total	
	N	%	N	%	N	%
Watching TV and DVD	33	78,6	26	59,1	59	68,6
Playing computer	16	38,1	10	22,7	26	30,2
Reading books and magazines	8	19,0	4	9,1	12	13,9
Painting and drawing, etc.	18	42,9	10	22,7	28	32,6
Strolls	9	21,4	0	0	9	10,5
Outdoor activities	38	90,5	40	90,9	78	90,7

Abbreviations: three answers at the maximum

As table 10 reveals, outdoor activities are the most preferable pastimes according to the respondents (girls – 90,5%, and boys – 90,9%). The children devote quite a lot of time to watching TV and DVDs (68,6%), especially the girls (78,6%) are more eager to engage in such activities than the boys (59,1%). Surprisingly, the girls took the smallest interest in reading books and magazines, (19,0%) whereas the boys in going for strolls (0%).

Discussion

Although PA in leisure time has relatively grown in popularity among Europeans over the years, this tendency manifests itself in a variety of forms rather than amount of time devoted to physical exercise (Cachay et al., 1990; Crum, 1993). It should be stated, however, that the number of physically inactive people are increasing all over the world, which is largely due to socio-cultural factors such as gender, age, socioeconomic status, geographic location and urbanization status (Scheerder et al., 2002; Falgairette et al., 2004).

This research revealed that the children living in rural areas were eager to participate in school P.E. classes, and their absence was sporadic and caused mainly by illness. Plays and games with a ball as well as races were the most favorite and popular forms of PA among the children. The games with other equipment and gymnastics were more favored by the girls, whereas the boys preferred matches and competitions. As can be seen from the above data, PA of the early school children takes the form of a rather spontaneous play or results from the willingness to compete (among boys). Consequently, the intensity of physical exercises performed in this way may be insufficient. This assumption was confirmed by the research conducted with 6-7-year-old children in the United States as participants, which showed that despite a relatively high motor activity of these children during a day and their eagerness to be involved in physical activities, less than 2% of the time allotted to PA was devoted to intensive physical exercises, while 80% of this time was filled with freestyle and low-intensity physical exercises (Gilliam et al., 1981).

In our research the vast majority of girls and boys expressed the opinion that P.E. classes should be compulsory to everyone. According to the statistics provided by the Surgeon General, only 3,8% of early school children devote approximately 6 minutes a day to PA (Lee et al., 2007). For the reason that primary school is frequently the sole center which gives children an opportunity to participate in physical activities, P.E. classes should be part of the school daily schedule. Nevertheless, the number of compulsory P.E. classes is being continuously decreased or, worse still, even totally excluded from the curriculum (NASPE & AHA, 2006).

This research showed that most of the children spent some of their leisure time outdoors in the company of their friends or siblings. None of the children admitted to playing outdoor games with their parents. Such a worrying tendency was also observed among the children from primary school in Szydłowo, Poland (rural area) (Sławek et al., 2012), which can be mainly accounted for by the unlimited number of working hours on the farm.

The top popular pastimes were the following: cycling, roller skating, and during the winter time: ice skating, skiing. However, winter activities seem to be more the children's dream activities than their real involvement as sports facilities such as rinks and ski slopes are scarce in the region of Warmia & Mazury. What is more, they are also believed to be too expensive to be affordable to everyone. Playing the ball as well as races were the most favorite physical activities both at school and in the leisure time. Sadly, only a marginal percentage of rural children take part in targeted physical activities and sports training such as swimming. This mostly results from the lack of adequate facilities and qualified staff in the country (Jaworski, 1994; Nowakowski, 1996). Another worrying tendency is an excessive amount of time spent in front of TV, DVD, and computer (Lisicki & Wilk, 1998). The research conducted by Tucker (1986) revealed a significant relation between an excessive viewing time and low level of physical fitness and obesity as a consequence of the children's sedentary lifestyle.

Conclusions

The research showed that the early school children inhabiting rural areas were eager to participate in physical activities organized by school. The most favorite activities at school included games and plays with a ball and other equipment, races, gymnastics (among girls) and matches and competitions (among boys). According to the children the physical activities in which they are involved in their leisure time are spontaneous and unorganized in character and include physical activities such as: cycling, roller skating, skating and skiing. A marginal percentage of rural children participating in the research took part in organized and targeted physical activities such as sports trainings or swimming lessons. A relatively large number of the rural children under investigation devote a grate deal of their time to watching TV, DVDs, or playing on the computer.

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